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ENVIRONMENTAL MONITORING
OF STORED AMMUNITION
IN KUWAIT, 1996

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U.S. Army Armament Research, Development
and Engineering Center
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IN KUWAIT, 1996

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SIOAC-DEV), was tasked by U. S. Army Armament Research, Development and Engineering Center (ARDEC) to monitor ammunition storage conditions in MILVANS and above-ground magazines located in Kuwait. This report contains test results of data obtained January - December 1996.

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Armament Munitions and Chemical Command (AMCCOM), Rock Island, IL.

C. OBJECTIVE. The objective of the instrumentation was to obtain temperature and humidity data of the ammunition storage conditions inside MILVANS and above-ground magazines in Kuwait during 1996. The data obtained will be used by ARDEC, Technology Division, Product Assurance and Test Directorate, AMSTA-AR-QAN-P, to determine the reliability of ammunition stored in Kuwait.

D. CONCLUSION. The maximum temperature of an ammunition item stored in a MILVAN was 136.2 degrees Fahrenheit. The maximum repeatable temperature at an ammunition item stored in an above-ground magazine storage was 102.9 degrees Fahrenheit. Above-ground magazines hold a more constant temperature than MILVANS, as the storage temperature in MILVANS more closely tracks the ambient temperature. Above-ground magazines provide a storage temperature exceeding 100 degrees Fahrenheit a lower percentage of the time than MILVANS. However, the percentage of storage temperature readings exceeding 90 degrees Fahrenheit in above-ground magazines was greater than that in MILVANS. Additionally, a ceramic coating applied to MILVANS appeared to reduce the temperature at ammunition items stored inside.

PART 2

JANUARY - DECEMBER 1996

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PART 3

TEST SETUP

A weatherstation was set up at the ammunition supply point (ASP), approximately 50 km south-southwest of Kuwait City to monitor ambient conditions (wind speed, wind direction, ambient temperature, ambient humidity, solar radiation, and ground temperature). Readings were recorded every 15 minutes. The storage module for the weather station was swapped out and sent to DAC, SIOAC-DEV, every 6 months for downloading.

The temperature and humidity readings of eight MILVANs were obtained by ACR data loggers. These data loggers were placed at various strategic locations inside each MILVAN, such as top of load, 6 inches below top of MILVAN, etc. The data loggers were programmed to record readings every 30 minutes. Every 6 months, each data logger was replaced with a fresh data logger, with the initially installed data loggers shipped back to DAC, SIOAC-DEV. Table 1 displays the type of MILVAN storage and the DODIC contained by each MILVAN monitored.

TABLE 1: MILVAN SETUP

MILVAN	TYPE OF STORAGE	DODIC	DODIC DESCRIPTION
H3DA	Ceramic Painted	Unknown	None
25	Ceramic Painted	A589	.50 Caliber Cartridge
97	Ceramic Painted	Unknown	None
302	Ceramic Painted	Unknown	None
306	Ceramic Painted	N285	M577/577A1 Fuze
334	Ceramic Painted	D528	155mm Projectile
338	Ceramic Painted	D550	165mm Cartridge
411	Uncovered	Unknown	None

ACR data loggers were also placed inside 7 above-ground magazines to obtain temperature and humidity levels of stored ammunition. The data loggers were programmed to record a value every 30 minutes. Every 6 months, each data logger was replaced with a new data logger, with the initially installed data logger shipped back to DAC, SIOAC-DEV, for downloading. Table 2 contains a list of the above-ground magazines instrumented and their contents. Several items were moved from one above-ground magazine to another. For the purpose of this table, each of these items is listed with the above-ground magazine it was located the majority of the time.

TABLE 2: MAGAZINE SETUP

ABOVE-GROUND MAGAZINE	DODIC
4	C786, C787
5	D533, D540, D509, C697, N286
6	K180, M023
7	N464, N285
8	D541, D502, D563
9	D505
13	A589

PART 4

TEST RESULTS

Eight uncovered MILVANS were instrumented. Seven of these MILVANS were painted with a ceramic coating. Table 1 in Part 3 of this report contains a detailed list of the MILVANS instrumented.

Due to the climate in Kuwait, heat is the most important factor in the breakdown of ammunition in storage. Table 3 contains the maximum temperatures at various MILVAN storage locations during each of the 10 hottest days of 1996.

Table 3

MILVAN Storage; 10 Hottest Days

Julian Date	Ambient	A589 (25)	N285 (306)	D550 (338)	Top (H3DA)	6" Below Top (H3DA)*	6" Below Top (334)*	D528 (334)*	Top (#411)*	6" Below Top (#411)*
183	117.9	128.5	136.2	119.7	133.9	128.5	126.5	113.5	153.4	141.0
186	117.9	126.5	132.8	116.1	122.5	124.5	123.5	106.9	141.0	129.6
233	117.9	N/A	133.9	118.8	133.9	128.5	126.5	106.1	153.4	141.0
195	117.8	127.5	132.8	117.9	129.6	124.5	123.5	108.5	149.0	133.9
187	117.1	125.5	130.6	115.2	122.5	122.5	122.5	108.5	138.6	127.5
231	116.9	N/A	133.9	118.8	128.5	127.5	125.5	106.1	149.0	139.8
194	116.7	126.5	132.8	115.2	124.5	122.5	122.5	106.1	147.6	131.7
230	116.6	N/A	129.6	116.1	122.5	124.5	121.6	105.3	142.3	133.9
225	116.5	N/A	126.5	114.3	119.7	121.6	120.6	107.7	132.8	125.5

* Instrumented MILVAN in parenthesis (No.)

The maximum temperature of an ammunition item was 136.2 degrees Fahrenheit on Julian date 183. The load consisted of fuzes, DODIC N285. The fuzes and small arms items generally reached higher temperatures than the projectiles and large cartridges. This result appears to be due to the smaller mass of these items, resulting in a faster heat soak. Note also that MILVAN

411 was the only MILVAN with no ceramic paint coat. No ammunition item on the inside of MILVAN 411 was instrumented. However, the temperatures reached on the top of MILVAN 411 and 6 inches below the top of MILVAN 411 were consistently higher than the temperatures at the same locations of their ceramic-painted MILVAN counterparts. Therefore, the ceramic paint appears to be an effective means of reducing the temperature of ammunition stored in MILVANs.

The temperatures were at the most extreme from June - September 1996. Table 4 shows a breakdown of the percentage of time each month the temperature exceeded 90 degrees and 100 degrees for ambient temperature and ammunition items stored in MILVANs. All the items in this table were stored in ceramic-painted MILVANs. No data were available on items stored in MILVANs without a ceramic paint coating.

Table 4
Percentage of MILVAN Temperature Readings by Month

% >	Month	Ambient	A589	N285	D528	D550
90	Jun	67.4	76.5	70.6	61.7	59.4
100	Jun	36.3	46.3	46.7	8.7	34.3
90	Jul	84.8	94.6	90.3	91.1	75.6
100	Jul	47.5	56.8	52.6	35.5	43.8
90	Aug	82.7	N/A	88.2	90.4	75.7
100	Aug	48.0	N/A	51.1	35.4	43.2
90	Sep	58.8	N/A	71.8	57.0	53.1
100	Sep	27.9	N/A	42.0	22.4	27.5

Table 4 illustrates again that the fuzes and small arms items are at the elevated temperature a greater percentage of the time than the large cartridges and projectiles. This is particularly evident in the percentage of time each item was in storage in excess of 100 degrees. The larger mass of the projectiles and large cartridges appears to slow the heat soak process.

The Kuwait environment is generally very dry. Table 5 contains the peak relative humidity levels of each item stored in MILVANS by month from May - October, the months that contain the most harsh combination of temperature and humidity.

Table 5
Relative Humidity of MILVAN Storage

Month	Ambient	A589	D528	D550	N285
May	100.0	26.1	36.4	24.5	23.1
Jun	95.3	30.1	37.9	54.8	36.4
Jul	100.0	30.1	37.9	60.1	40.5
Aug	100.0	N/A	37.9	60.1	40.5
Sep	100.0	37.0	45.1	74.2	40.5
Oct	100.0	N/A	41.6	74.2	N/A

*All values in percent relative humidity

The peak relative humidity values of the ammunition items stored inside the MILVANS are consistently lower than the peak ambient relative humidity values. Nonpeak relative humidity values inside MILVANS below 20 percent are prevalent in most cases. The MILVANS appear to seal reasonably well, as an ambient relative humidity reading of 100 percent did not translate to a reading near 100 percent on the inside of the MILVAN.

Seven above-ground magazines contained storage items which were instrumented. Movement of items from one above-ground magazine to another occurred with several items. Table 2 in Part 3 contains a listing of where each item was located the majority of the time.

Table 6 contains a listing of the days containing the 10 hottest ambient temperatures. Also included in this table are the storage temperatures at one ammunition item within each above-ground magazine. A listing of peak temperatures for items stored in each above-ground magazine is contained in Part 6 of this report.

Table 6
10 Hottest Days

Julian Date	Ambient	C786 (Mag 4)	D533 (Mag 5)	K180 (Mag 6)	N464 (Mag 7)	D541 (Mag 8)	D505 (Mag 9)
183	117.9	98.4	113.5	100.7	99.2	100.7	102.2
186	117.9	93.4	99.9	94.1	94.1	97	99.2
233	117.9	98.4	102.9	99.9	98.4	100.7	102.2
195	117.8	95.5	101.4	97	96.3	98.4	99.9
187	117.1	93.4	100.7	94.8	94.1	97	99.2
231	116.9	98.4	102.2	99.9	98.4	100.7	102.2
194	116.7	94.8	100.7	97	95.5	98.4	99.2
230	116.6	98.4	102.2	99.9	98.4	100.7	101.4
225	116.5	97.7	102.9	98.4	98.4	100.7	102.2
196	116.4	95.5	102.2	97.7	97.0	99.2	101.4

*All values in degrees Fahrenheit

Maximum temperatures vary only slightly from above-ground magazine to above-ground magazine. The 113.5 degrees recorded in above-ground magazine 5 on Julian date 183 appears to be an aberration. One possible explanation of this reading is the above-ground magazine may have been open that day. Several items contained in above-ground magazine 5 showed peak temperatures in excess with any other peak temperature on that Julian date. Peak storage temperatures inside the above-ground magazines are consistently lower than MILVAN storage peak temperatures.

Table 7 contains the peak relative humidity values at one item in each above-ground magazine from May - October. These months contain the greatest combination of heat and humidity.

Table 7
Monthly Peak Above-ground Magazine Humidity Readings

	Ambient	C786 (Mag 4)	D533 (Mag 5)	K180 (Mag 6)	N464 (Mag 7)	D541 (Mag 8)	D505 (Mag 9)
May	100.0	N/A	53.9	66.6	57.4	40.2	42.7
Jun	95.3	N/A	53.4	67.6	58.0	40.2	45.5
Jul	100.0	45.1	53.9	67.6	58.0	40.2	45.5
Aug	100.0	45.1	43.3	44.1	39.8	25.2	34.1
Sep	100.0	50.8	46.3	51.5	48.5	30.1	43.8
Oct	100.0	41.2	41.8	39.0	41.0	25.2	43.8

The relative humidity values in above-ground magazines appear to remain more stable than the relative humidity values in MILVANs. The peak values in MILVANs were slightly higher than inside above-ground magazines. However, relative humidity readings below 20 percent were more frequent in MILVANs than in above-ground magazines.

Table 8 contains the temperature distribution of one ammunition item stored in each above-ground magazine.

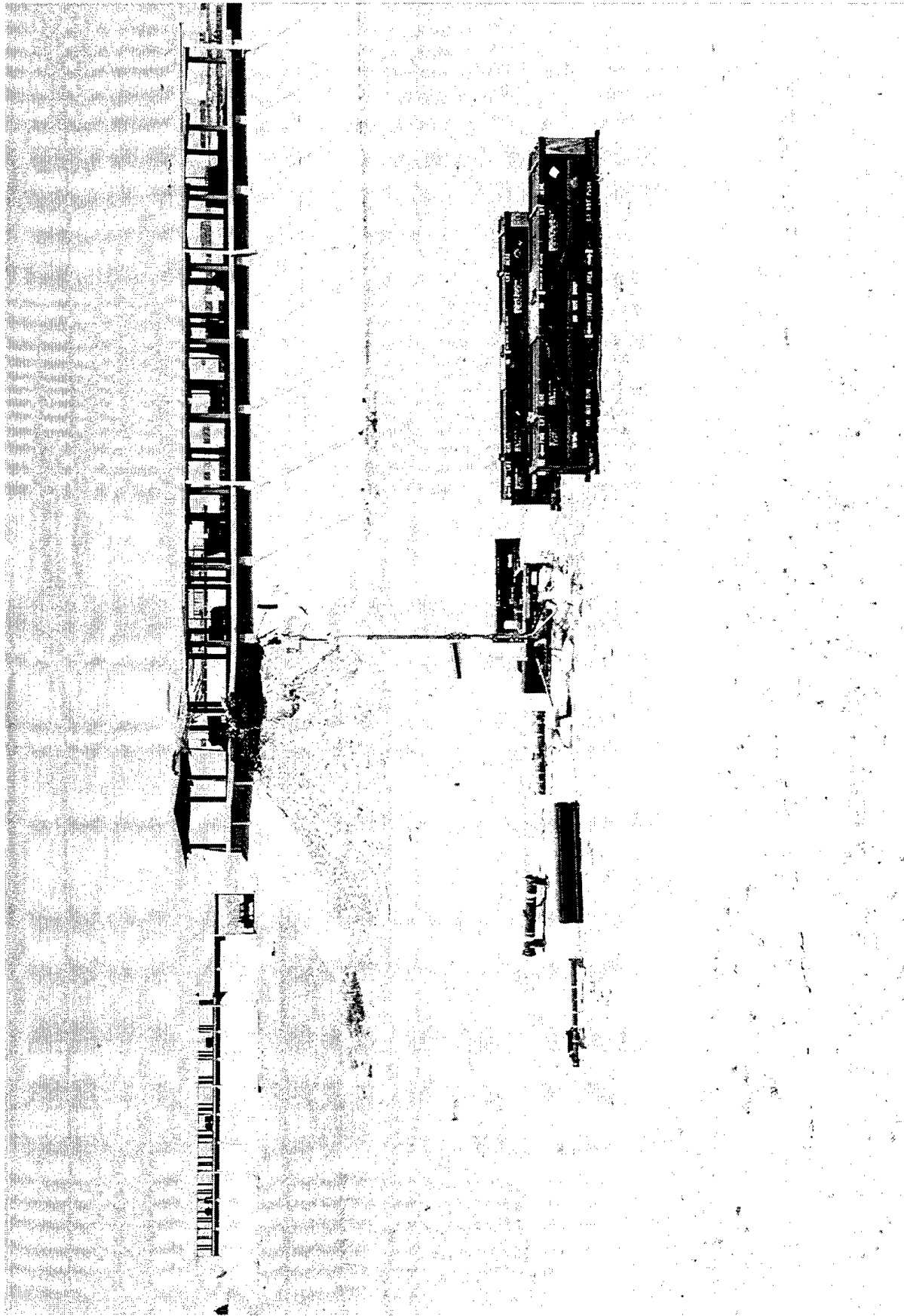
Table 8
Above-ground Magazine Temperature Distribution by Percentage

% >	Month	Ambient	C786	D533	K180	N464	D541	D505
90	Jun	67.5	N/A	100	81.5	49.6	100	100
100	Jun	36.7	N/A	0	0	0	0	0
90	Jul	84.9	100	100	100	100	100	100
100	Jul	47.7	0	58.8	0	0	0	33.3
90	Aug	82.8	100	100	100	100	100	100
100	Aug	47.1	0	97.6	1.0	0	40.6	92.8
90	Sep	57.8	99.5	98.8	100	100	100	100
100	Sep	27.0	0	1.8	0	0	0	10.6

The high percentage of temperatures ranging between 90 degrees and 100 degrees indicates the temperature during these months remains relatively constant in comparison to the temperatures in MILVANS. It appears the above-ground magazines provide temperatures below 100 degrees and temperatures in excess of 90 degrees more often than MILVANS. MILVANS more closely track ambient temperatures.

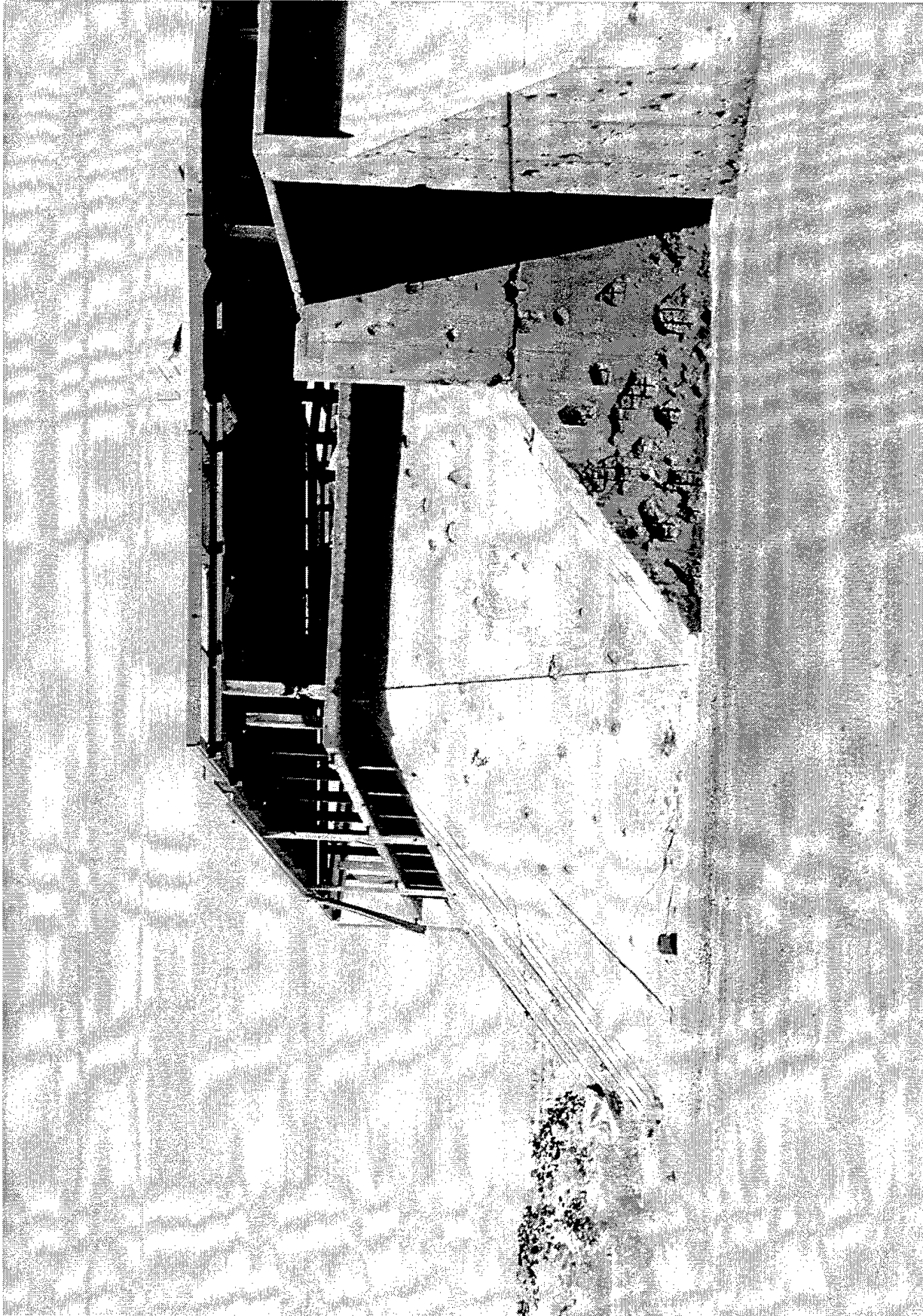
PART 5

PHOTOGRAPHS



U.S. ARMY DEFENSE AMMUNITION CENTER

PHOTO NO. A0317-SCN-93-188-3243. This photo shows the weather station setup at the ASP in Kuwait.



U.S. ARMY DEFENSE AMMUNITION CENTER

PHOTO NO. A0317-SCN-93-188-3265. This photo shows a typical storage above-ground magazine instrumented in Kuwait.



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<p>PHOTO NO. A0317-SCN-92-334-3428. This photo shows an ACR data logger installed on DODIC item K180 in an above-ground magazine. The wire entering the box from the data logger is the external probe.</p>



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<p>PHOTO NO. A0317-SCN-92-334-3431. This photo shows DODIC C697 in storage in a MILVAN. Note the data logger and external probe are fastened to the item.</p>		
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PART 6

TABLES

Table 9

Monthly Peak Temperatures for Above-ground Magazine 4 Items

1996	Ambient	C787	Ext. Probe C787	C786	Ext. Probe C786
May	113.1	87.9	87.9	N/A	N/A
Jun	114.9	92.7	92.7	N/A	N/A
Jul	117.9	96.7	97.7	98.4	98.4
Aug	117.9	N/A	N/A	98.4	98.4
Sep	117.9	94.1	94.1	98.4	98.4
Oct	104.6	94.1	94.1	94.1	94.1
Nov	92.8	85.2	85.9	85.9	85.9
Dec	100.2	92.7	92.7	93.4	93.4

*All values in degrees Fahrenheit

Table 10

Monthly Peak Temperatures for Above-ground Magazine 5 Items

1996	Am- bient	Front	Rear	C787	Ext. Probe C787	D533	Ext. Probe D533	D540	Ext. Probe D540	D509	C697	N286	Ext. Probe N286	PD62
Jan	71.1	69.7	70.3	69.7	69.7	70.3	70.3	70.3	70.3	70.9	69.7	N/A	N/A	70.3
Feb	84.2	69.7	69.0	69.7	69.7	81.2	70.3	70.3	69.7	70.3	69.7	N/A	N/A	69.7
Mar	83.5	72.2	71.6	72.2	72.2	70.3	72.8	72.8	72.8	72.2	72.2	N/A	N/A	72.2
Apr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
May	113.1	91.3	89.9	93.4	94.1	94.8	94.8	94.8	94.8	88.6	91.3	89.9	88.6	N/A
Jun	114.9	94.8	94.1	97.7	97.7	98.4	98.4	127.5	115.2	92.7	95.5	93.4	92.7	N/A
Jul	117.9	100.7	99.9	127.5	114.3	113.5	115.2	127.5	115.2	99.2	100.7	100.7	99.9	N/A
Aug	117.9	100.7	99.9	102.2	102.2	102.9	102.9	99.9	99.9	99.2	100.7	99.9	99.2	N/A
Sep	117.9	100.7	99.9	102.2	102.2	102.9	102.9	99.9	99.9	99.2	100.7	99.9	99.2	N/A
Oct	104.6	94.1	94.1	N/A	N/A	94.1	94.1	94.1	94.1	94.1	94.1	93.4	93.4	N/A
Nov	92.8	84.5	85.9	N/A	N/A	84.5	84.5	85.2	85.2	85.9	99.9	81.2	81.9	N/A
Dec	100.2	92.7	93.4	N/A	N/A	92.7	92.7	93.4	92.7	99.9	91.3	91.3	91.3	N/A

*All values in degrees Fahrenheit.

TABLE 11

Monthly Peak Temperatures for Above-ground Magazine 6 Items

1996	Ambient	Front	Rear	M023	Ext. Probe M023	K180	Ext. Probe K180	M032	Ext. Probe M032
Jan	71.1	66.5	66.5	67.8	N/A	N/A	N/A	66.5	67.1
Feb	84.2	68.4	68.4	70.9	N/A	N/A	N/A	67.8	67.8
Mar	83.5	76.7	76.7	77.3	N/A	78.0	N/A	75.4	70.3
Apr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
May	113.1	89.9	88.6	90.6	N/A	89.9	87.6	N/A	N/A
Jun	114.9	93.4	92.7	94.1	N/A	94.1	93.4	N/A	N/A
Jul	117.9	99.2	99.2	99.9	99.9	100.7	99.9	N/A	N/A
Aug	117.9	99.2	99.2	99.9	99.9	100.7	99.9	N/A	N/A
Sep	117.9	99.2	99.2	99.9	99.9	100.7	99.9	N/A	N/A
Oct	104.6	93.4	93.4	94.1	94.1	94.1	93.4	N/A	N/A
Nov	92.8	83.2	83.2	85.9	84.5	84.5	85.0	N/A	N/A
Dec	100.2	92.0	93.4	92.7	92.0	93.4	92.7	N/A	N/A

*All values in degrees Fahrenheit.

TABLE 12

Monthly Peak Temperatures for Above-ground Magazine 7 Items

1996	Ambient	Front	Rear	N340	Ext. Probe N340	N464	Ext. Probe N464	N285
Jan	71.1	65.2	65.9	65.9	71.1	N/A	N/A	N/A
Feb	84.2	67.1	67.1	66.5	84.2	N/A	N/A	N/A
Mar	83.5	79.3	78.6	69.7	83.5	N/A	N/A	N/A
Apr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
May	113.1	88.6	98.9	N/A	N/A	88.6	88.6	N/A
Jun	114.9	92.7	92.0	N/A	N/A	92.7	92.7	N/A
Jul	117.9	99.9	99.9	N/A	N/A	99.2	99.2	102.2
Aug	117.9	99.2	98.4	N/A	N/A	98.4	99.2	N/A
Sep	117.9	99.2	98.4	N/A	N/A	98.4	99.2	92.7
Oct	104.6	92.7	93.4	N/A	N/A	92.7	93.4	92.7
Nov	92.8	81.2	83.2	N/A	N/A	97.0	96.3	81.2
Dec	100.2	90.6	92.0	N/A	N/A	87.0	96.3	91.3

*All values in degrees Fahrenheit.

TABLE 13

Monthly Peak Temperatures for Above-ground Magazine 8 Items

1996	Ambient	Front	Rear	D563	D502	D541	Ext. Probe D541
Jan	71.1	67.1	68.4	67.1	67.8	67.8	67.8
Feb	84.2	67.1	67.8	67.1	67.1	67.1	67.8
Mar	83.5	94.1	77.3	78.0	94.1	92.0	70.9
Apr	N/A	N/A	N/A	N/A	N/A	N/A	N/A
May	113.1	90.6	89.2	91.3	87.9	91.3	91.3
Jun	104.9	94.8	94.1	95.5	93.4	94.8	95.5
Jul	117.9	100.7	99.9	101.4	99.2	100.7	101.4
Aug	117.9	100.7	99.9	101.4	99.2	100.7	101.4
Sep	117.9	100.7	99.9	101.4	99.2	100.7	101.4
Oct	104.6	94.8	95.5	94.8	94.8	94.8	95.5
Nov	92.8	83.2	85.9	83.9	85.2	84.5	N/A
Dec	100.2	92.0	94.1	92.7	93.4	92.7	93.4

*All values in degrees Fahrenheit.

TABLE 14

Monthly Peak Temperatures for Above-ground Magazine 9 Items

1996	Ambient	Front	Rear	D505
Jan	71.1	68.4	69.0	69.7
Feb	84.2	68.4	69.0	69.0
Mar	83.5	86.5	86.5	89.2
Apr	N/A	N/A	N/A	N/A
May	113.1	92.7	90.6	93.4
Jun	104.9	96.3	94.8	96.9
Jul	117.9	101.4	99.9	102.2
Aug	117.9	101.4	99.9	102.2
Sep	117.9	101.4	99.9	102.2
Oct	104.6	94.1	94.8	94.8
Nov	92.8	81.9	84.5	83.9
Dec	100.2	92.7	93.4	92.7

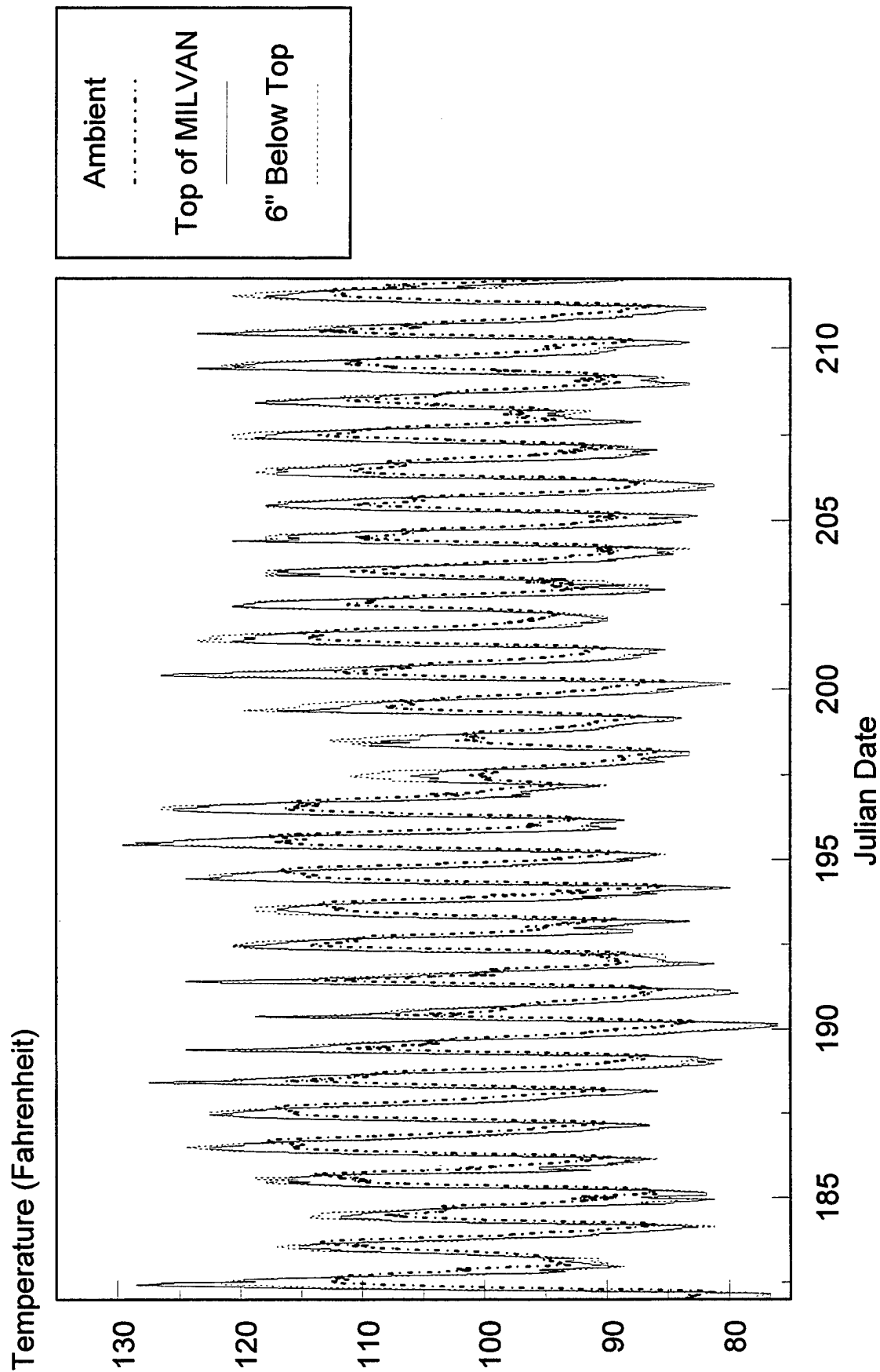
*All values in degrees Fahrenheit.

PART 7

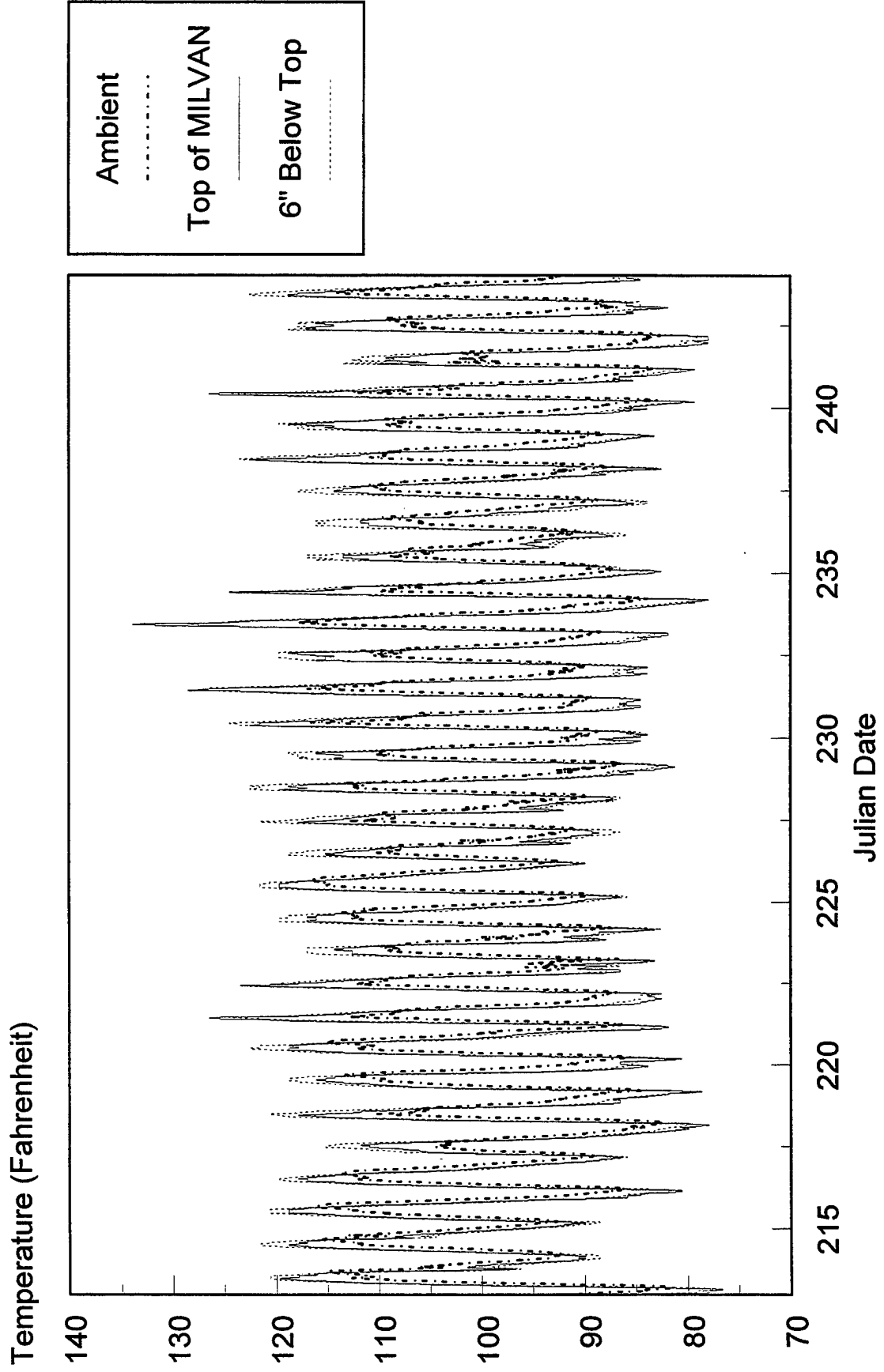
GRAPHS

MILVAN GRAPHS

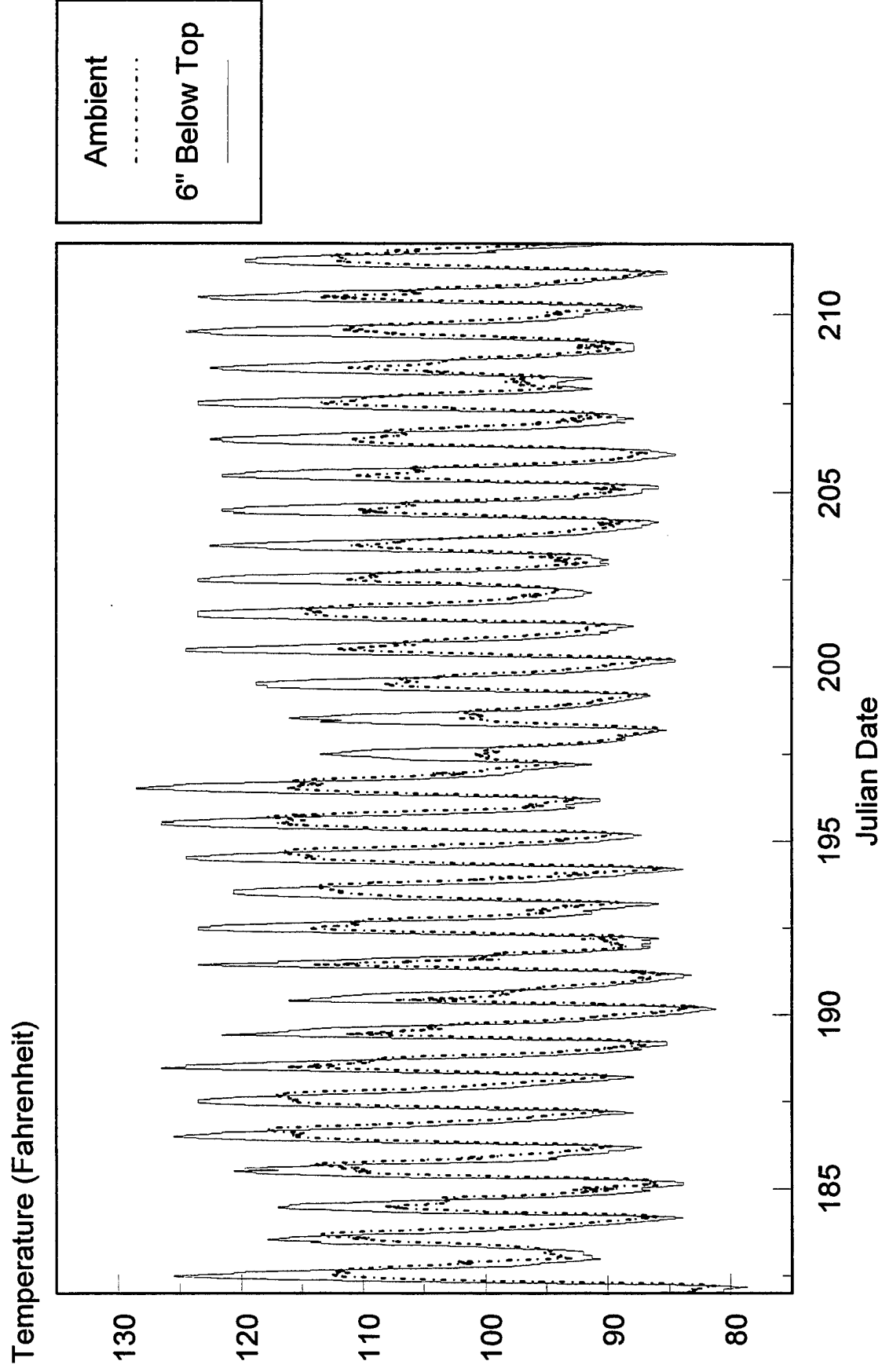
July 1996 Environmental Monitoring of Ammo Stored at Kuwait MILVAN H3DA



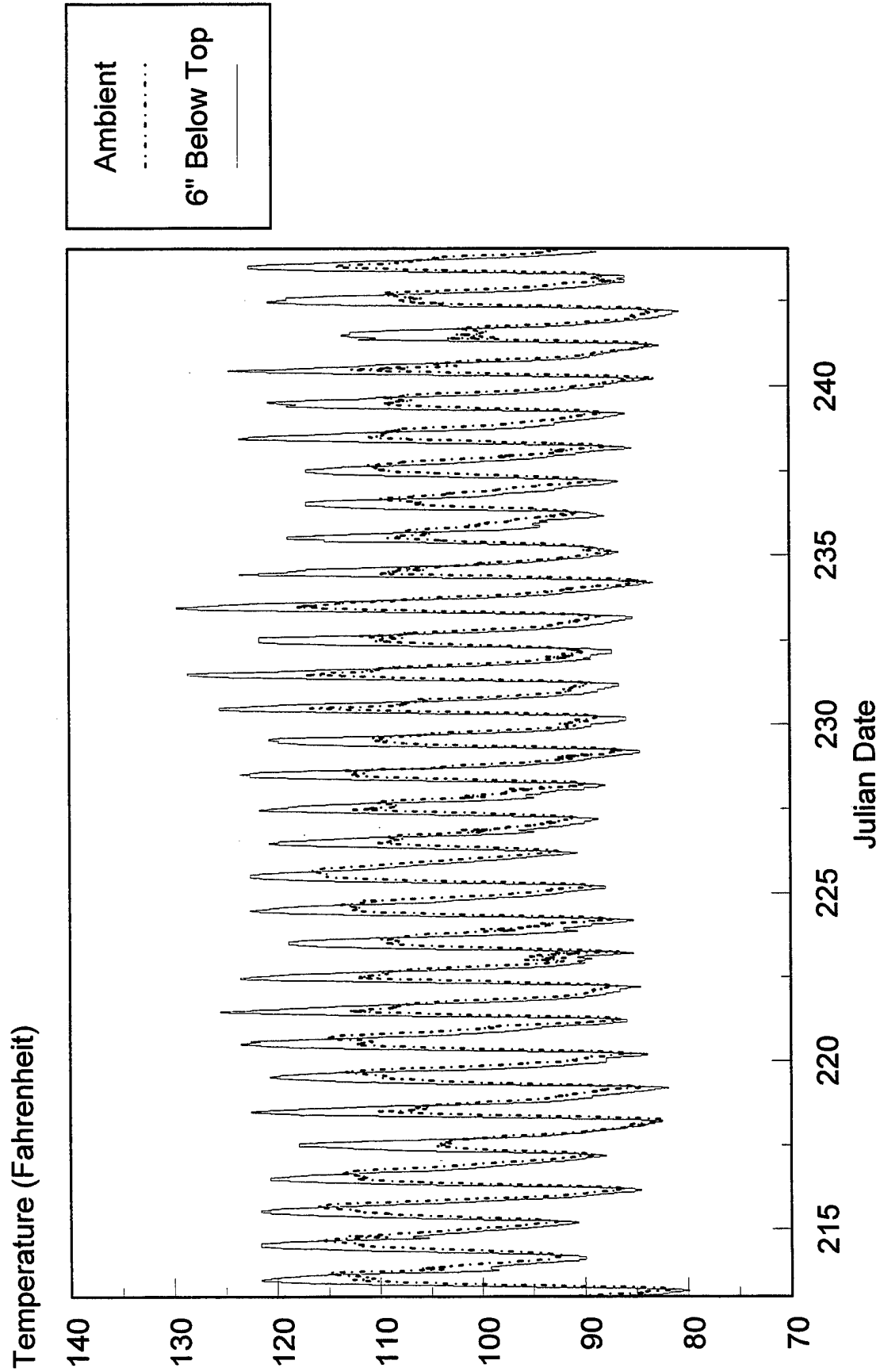
August 1996 Environmental Monitoring of Ammo Stored at Kuwait MILVAN H3DA



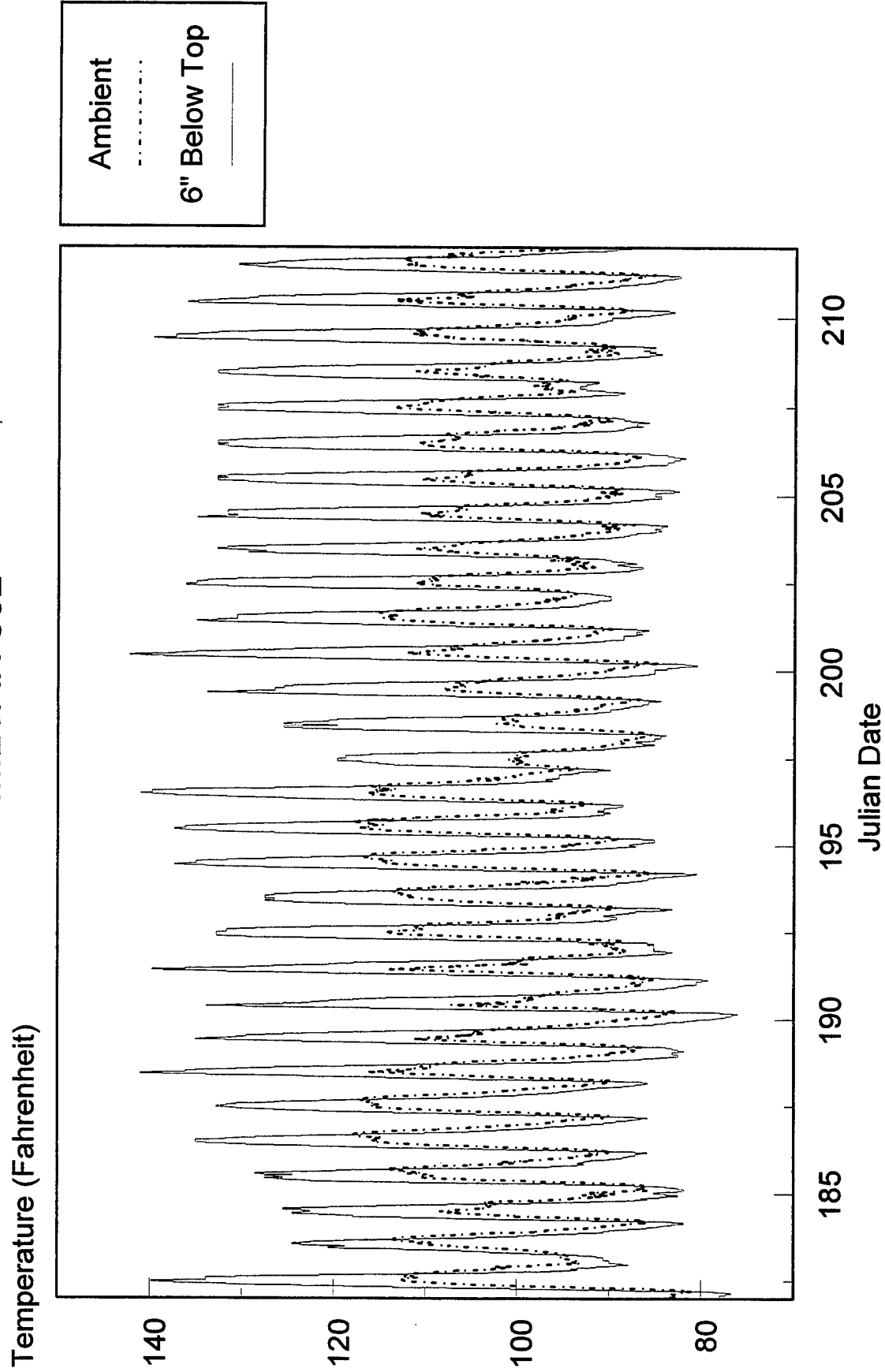
July 1996 Environmental Monitoring of Ammo Stored at Kuwait MILVAN 97



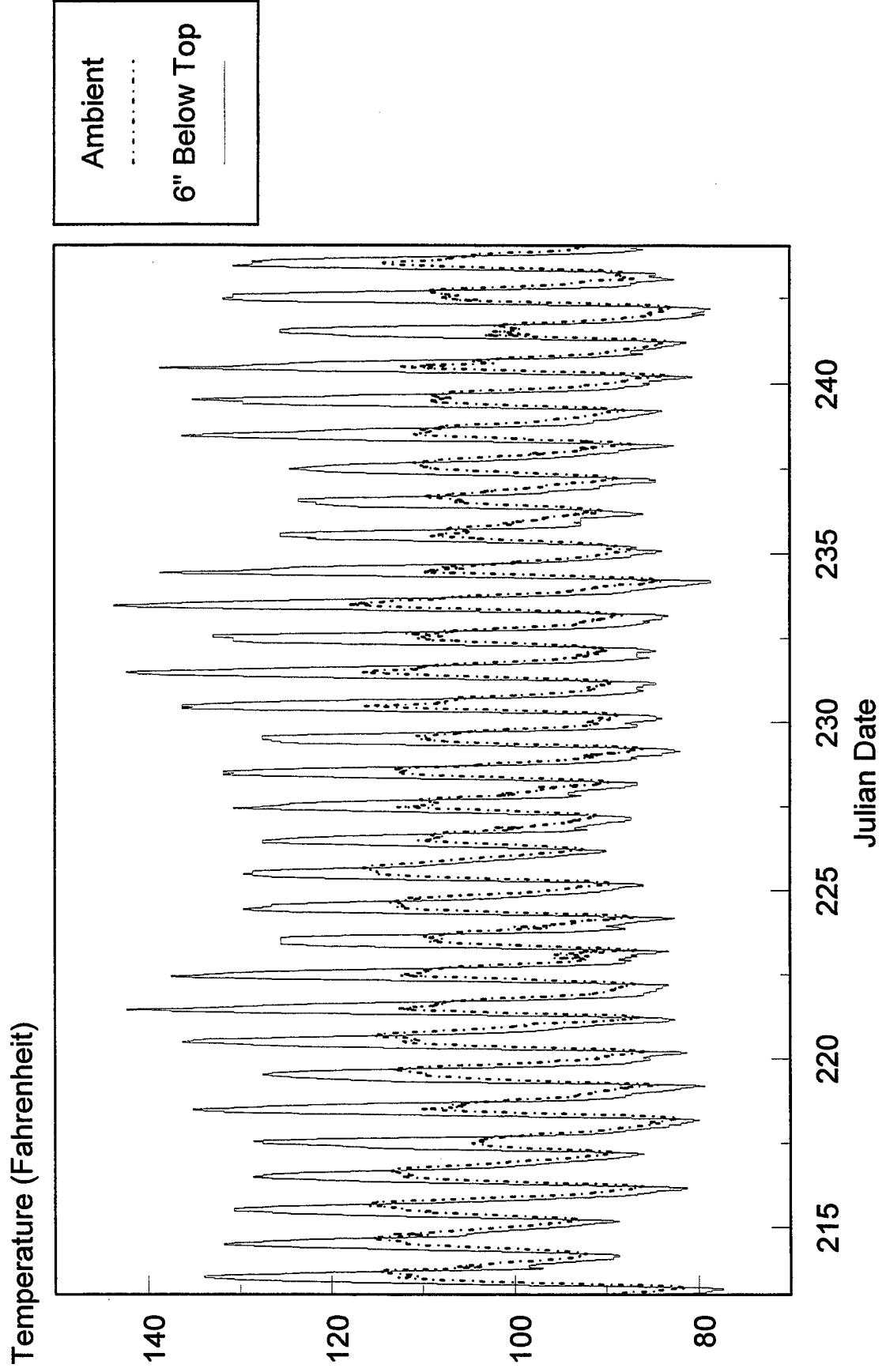
August 1996 Environmental Monitoring of Ammo Stored at Kuwait MILVAN 97



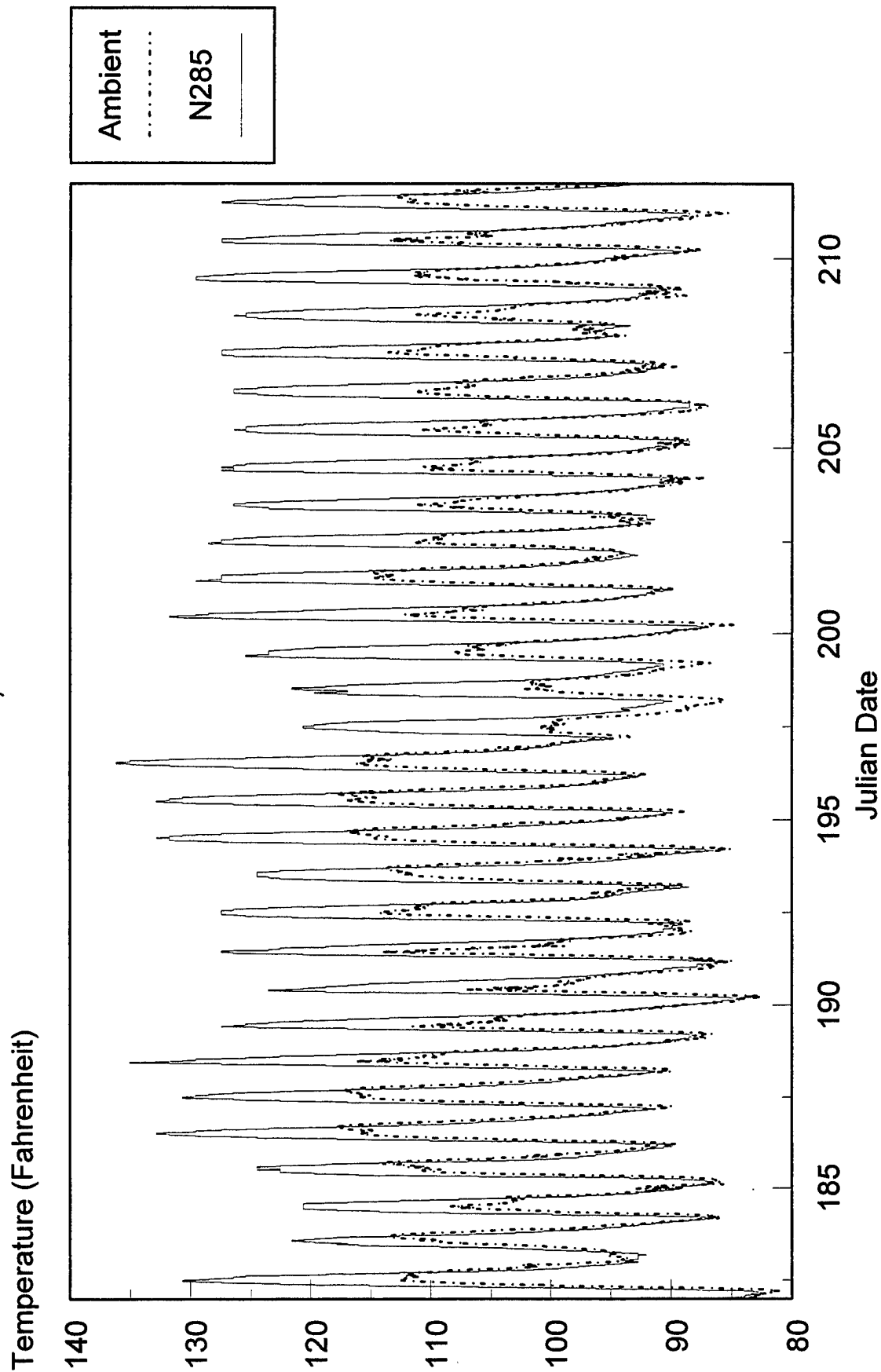
July 1996 Environmental Monitoring of Ammo Stored at Kuwait MILVAN 302



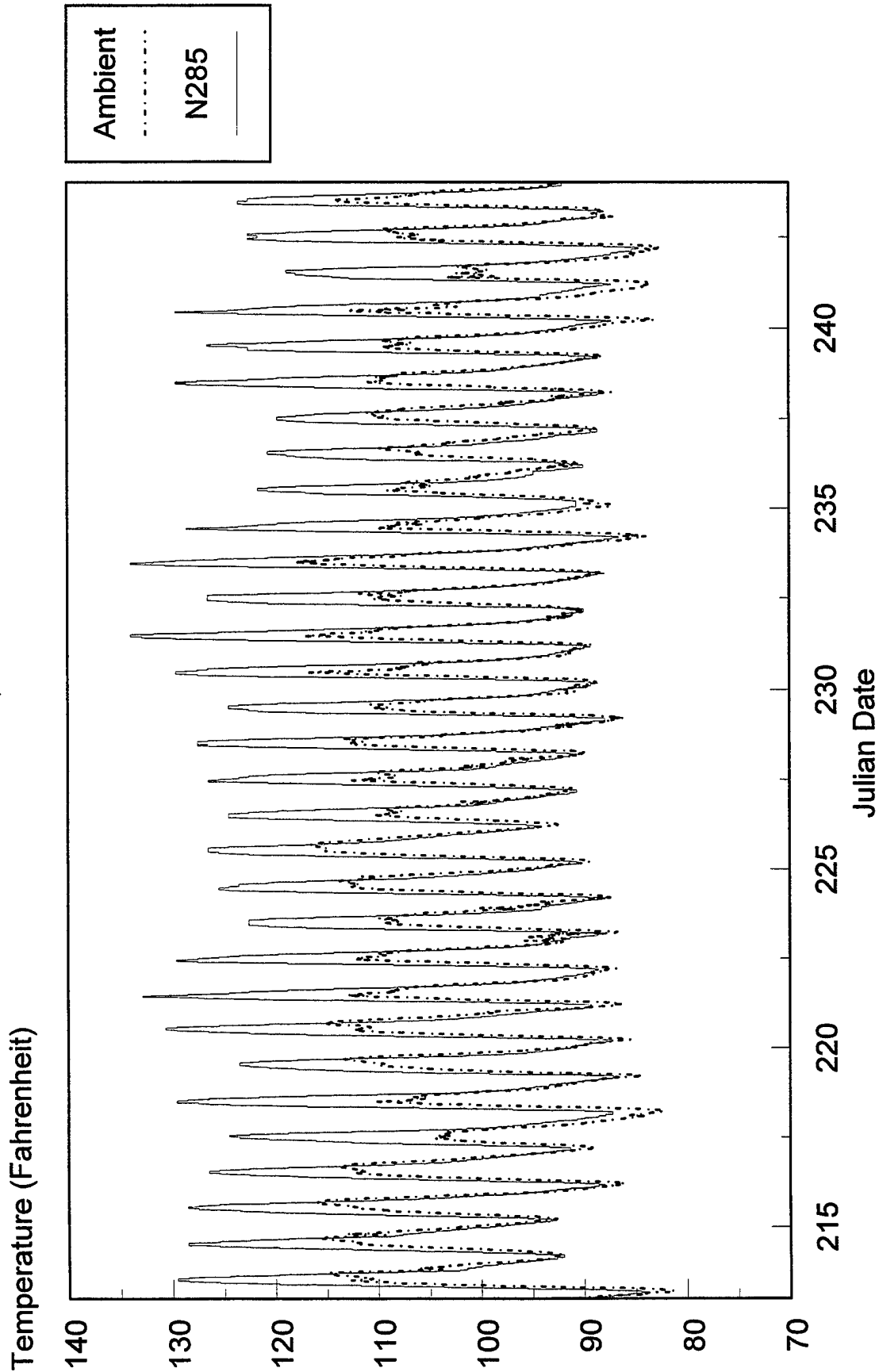
August 1996 Environmental Monitoring of Ammo Stored at Kuwait MILVAN 302



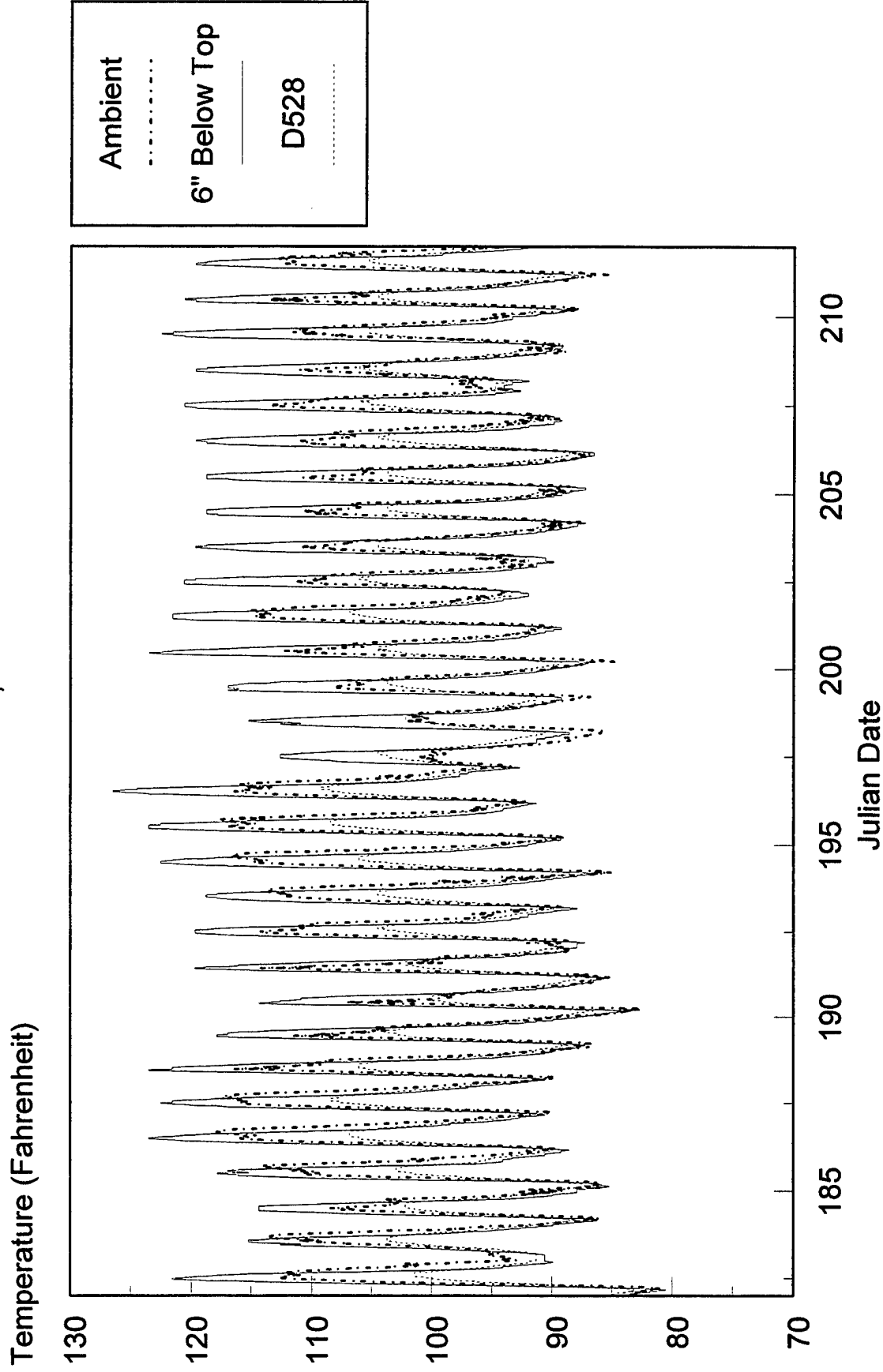
July 1996 Environmental Monitoring of Ammo Stored at Kuwait DODIC N285, MILVAN 306



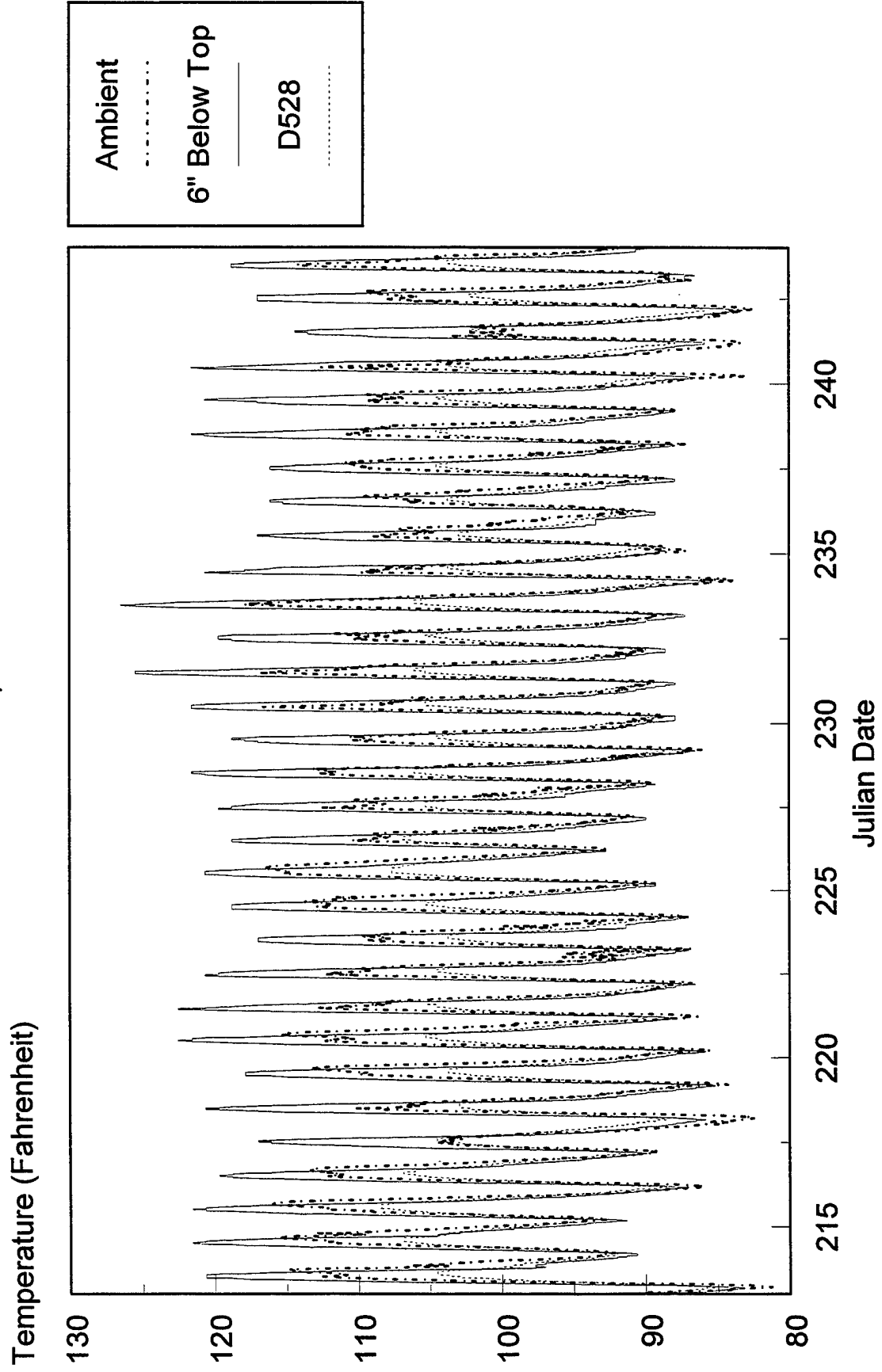
August 1996 Environmental Monitoring of Ammo Stored at Kuwait DODIC N285, MILVAN 306



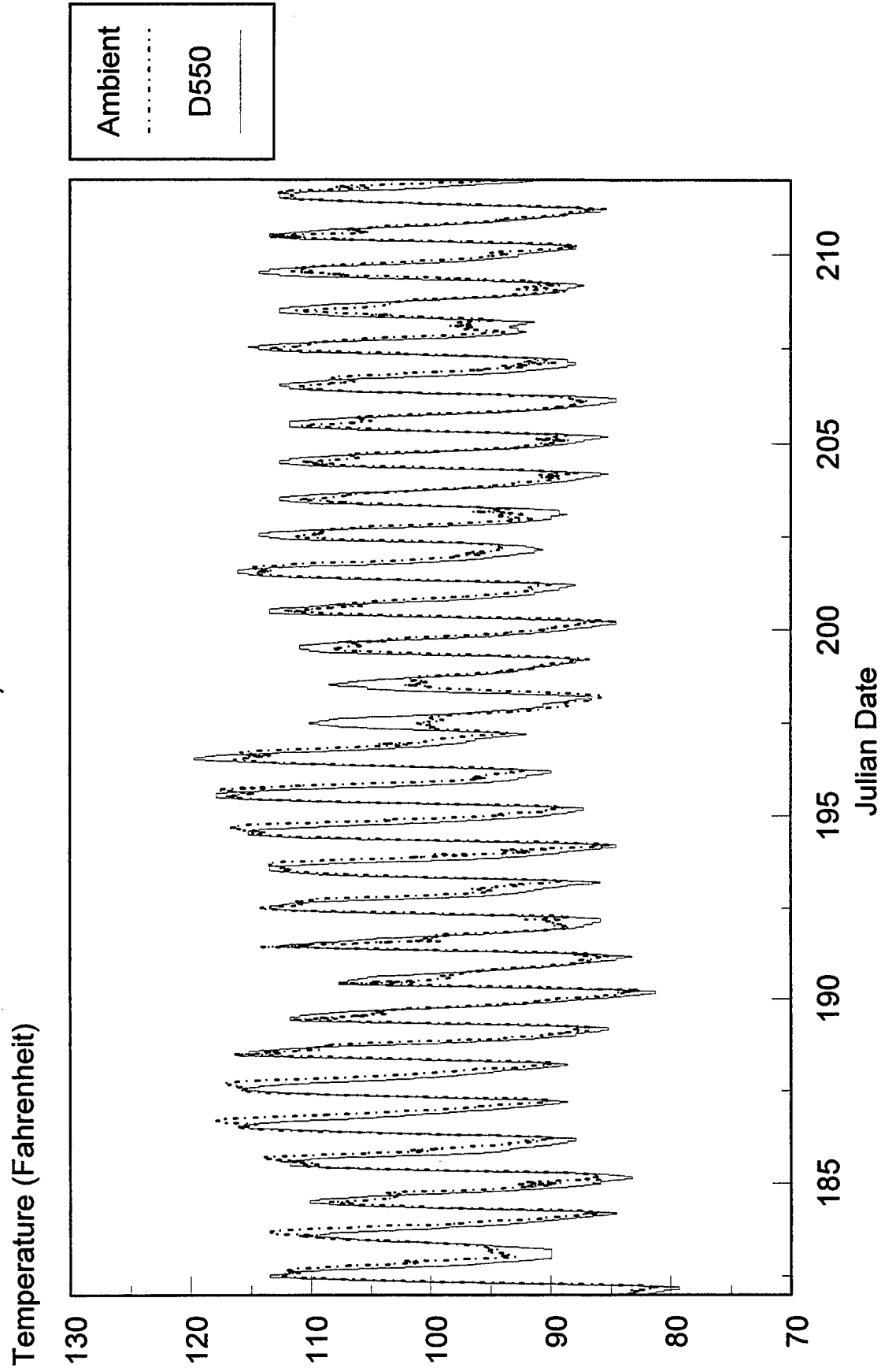
July 1996 Environmental Monitoring of Ammo Stored at Kuwait DODIC D528, MILVAN 334



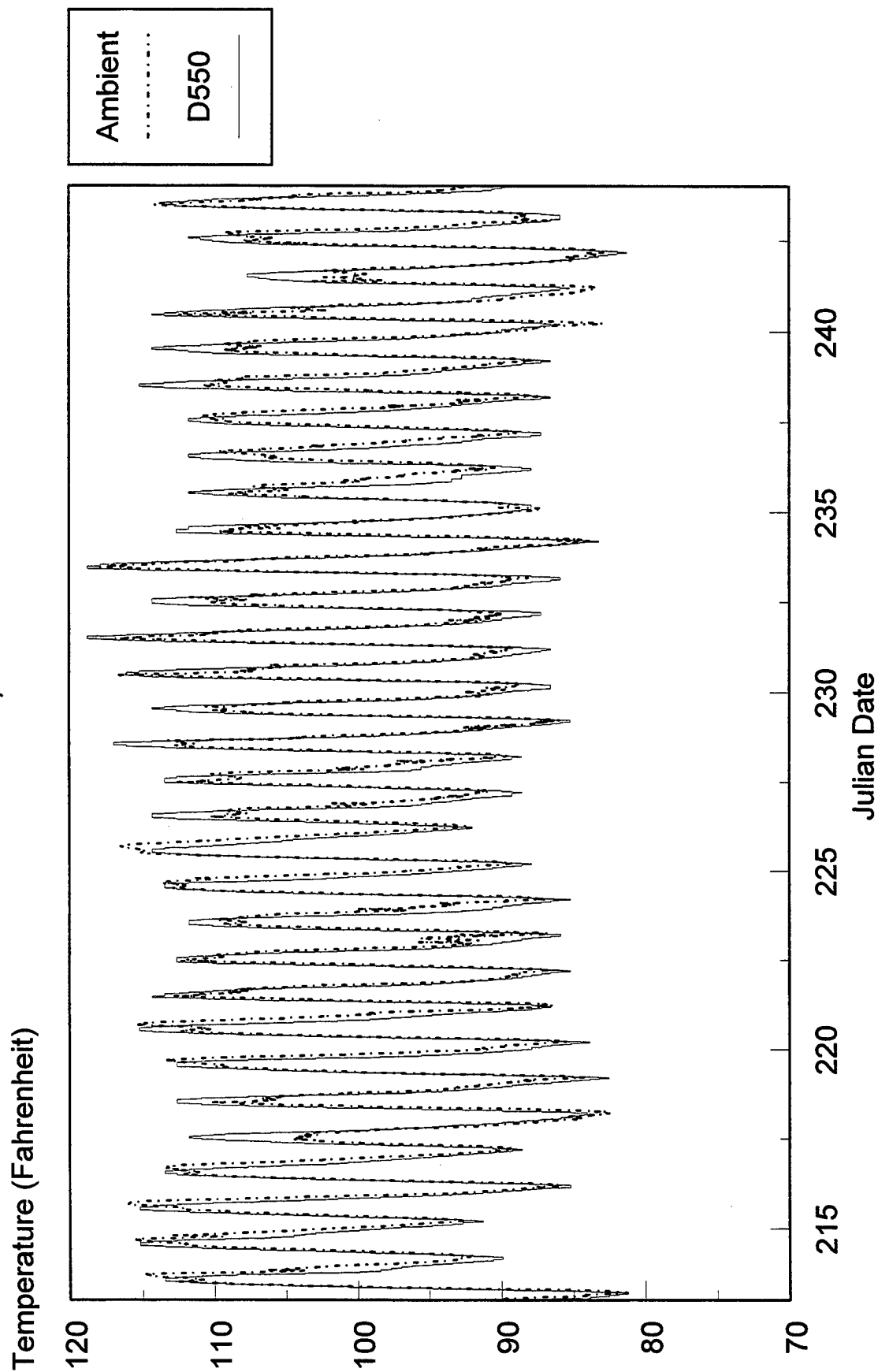
August 1996 Environmental Monitoring of Ammo Stored at Kuwait
DODIC D528, MILVAN 334



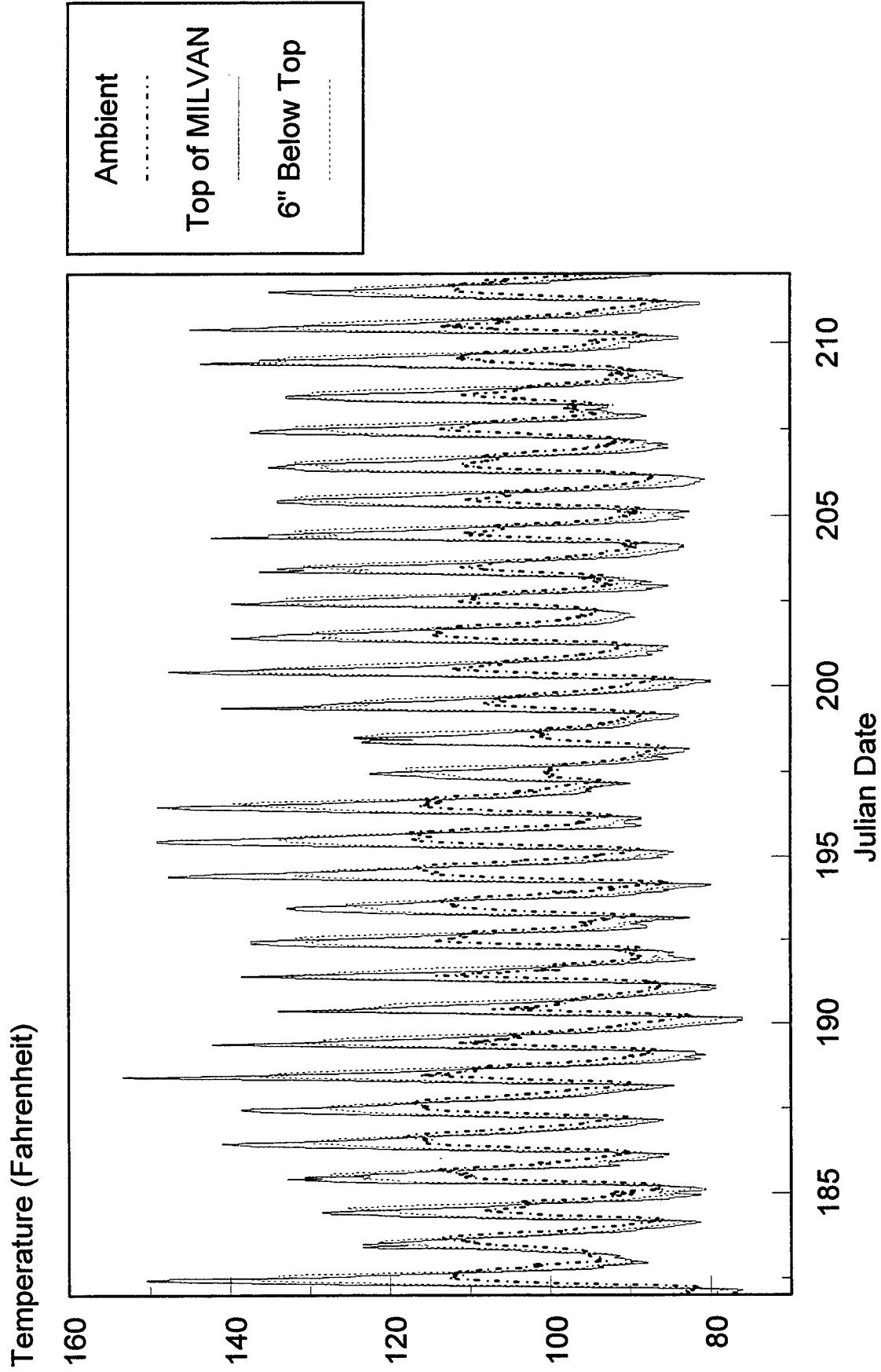
July 1996 Environmental Monitoring of Ammo Stored at Kuwait DODIC D550, MILVAN 338



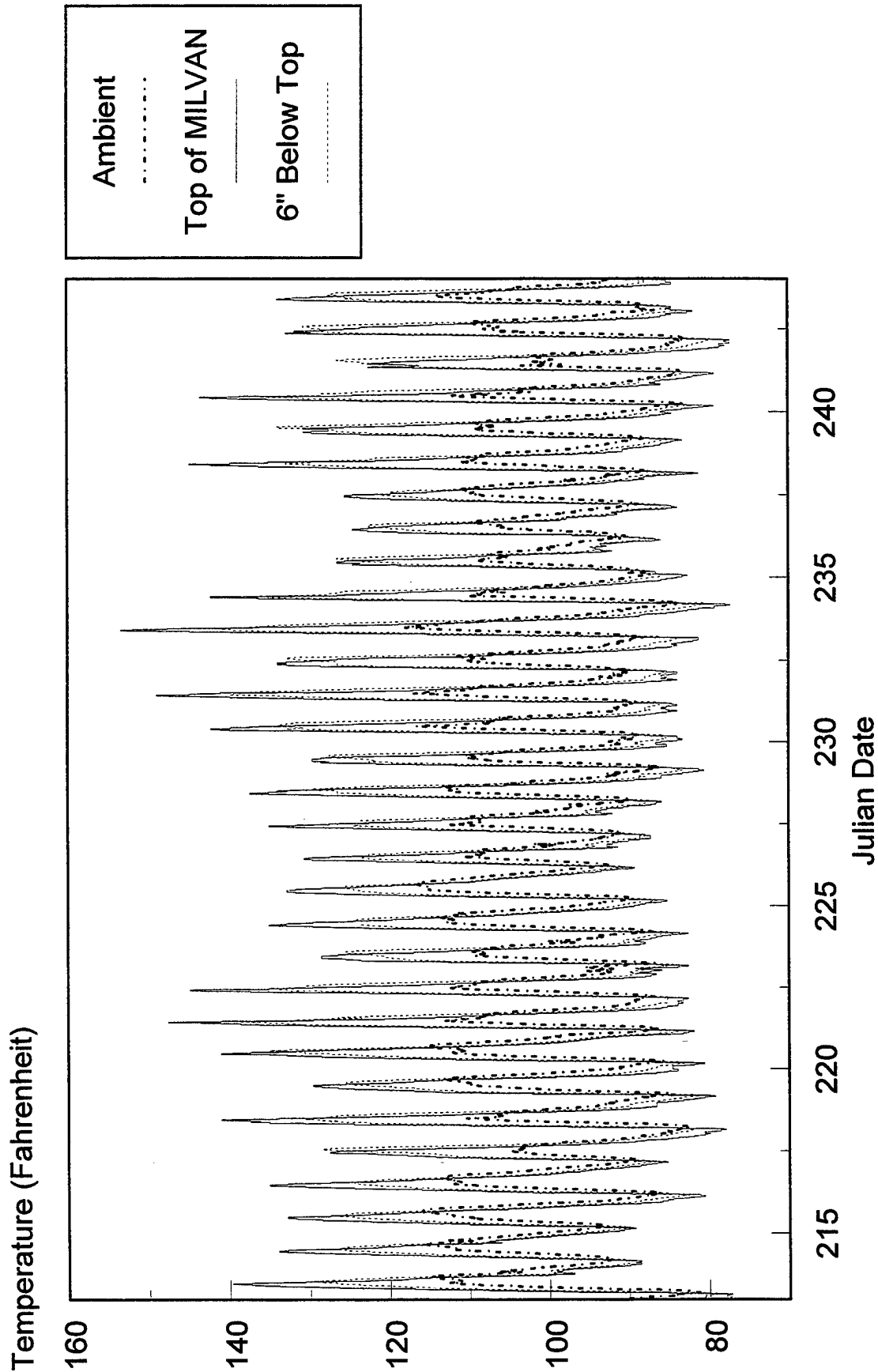
August 1996 Environmental Monitoring of Ammo Stored at Kuwait DODIC D550, MILVAN 338



July 1996 Environmental Monitoring of Ammo Stored at Kuwait MILVAN 411

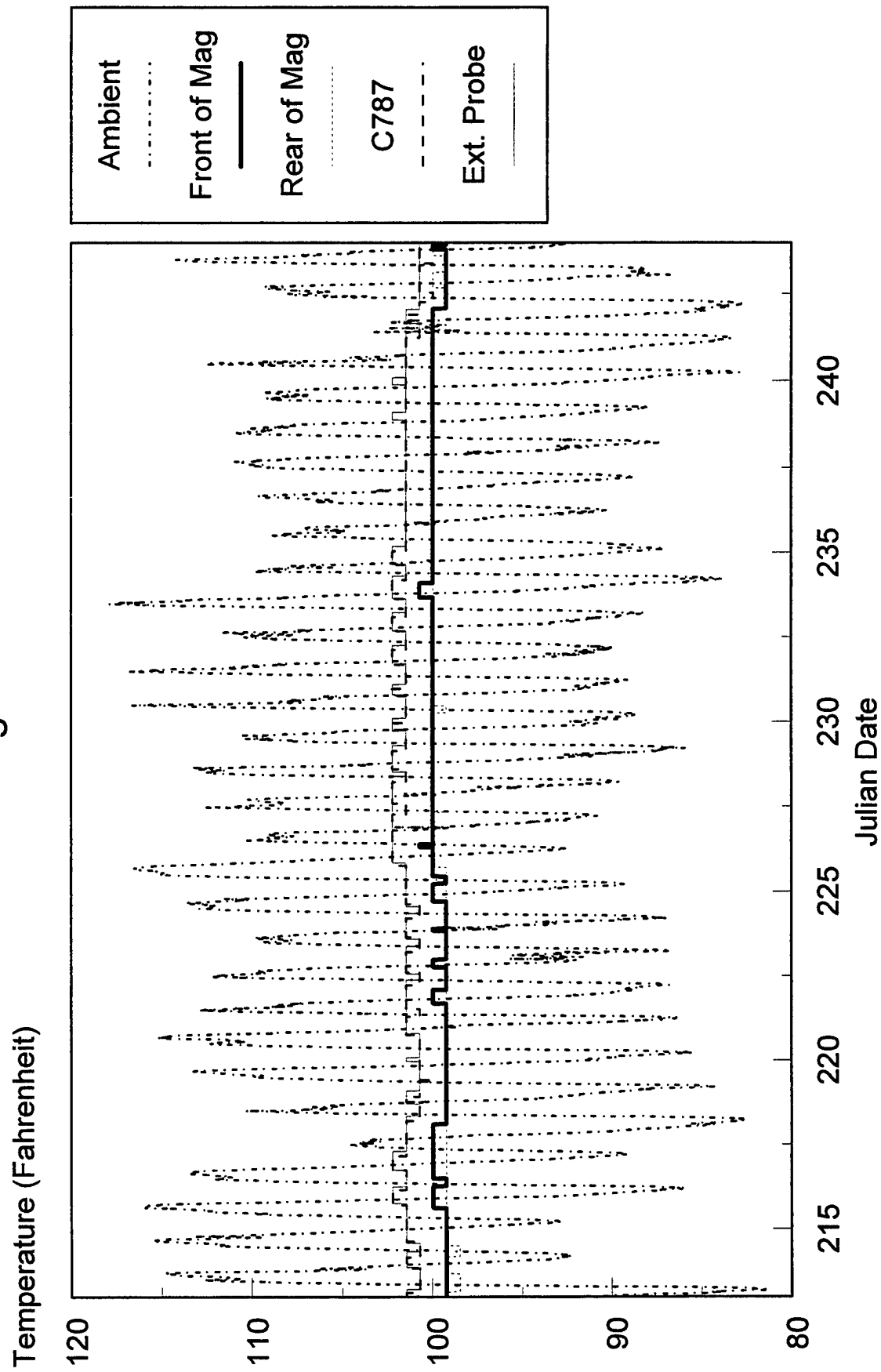


August 1996 Environmental Monitoring of Ammo Stored at Kuwait MILVAN 411

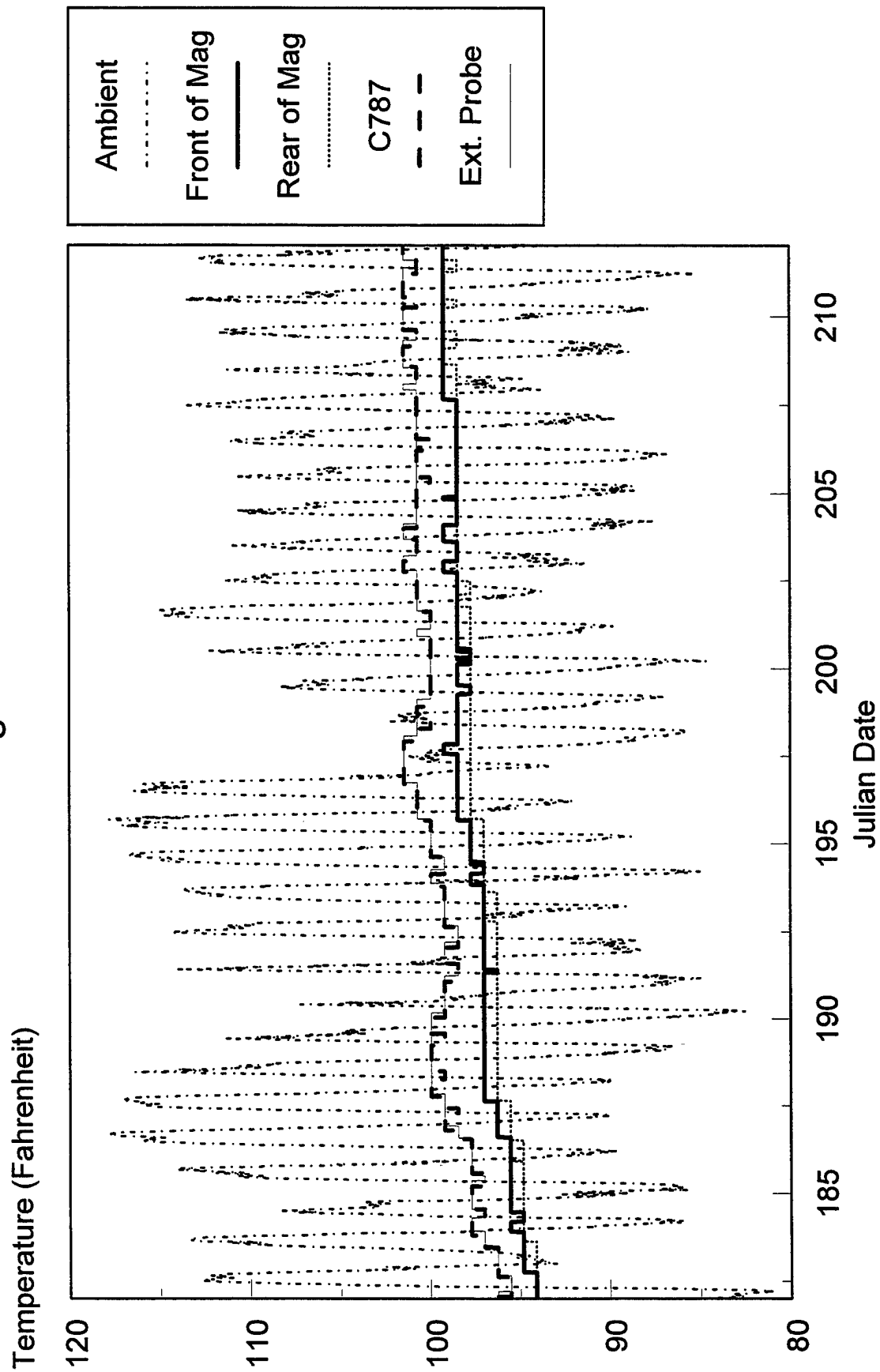


ABOVE-GROUND MAGAZINE GRAPHS

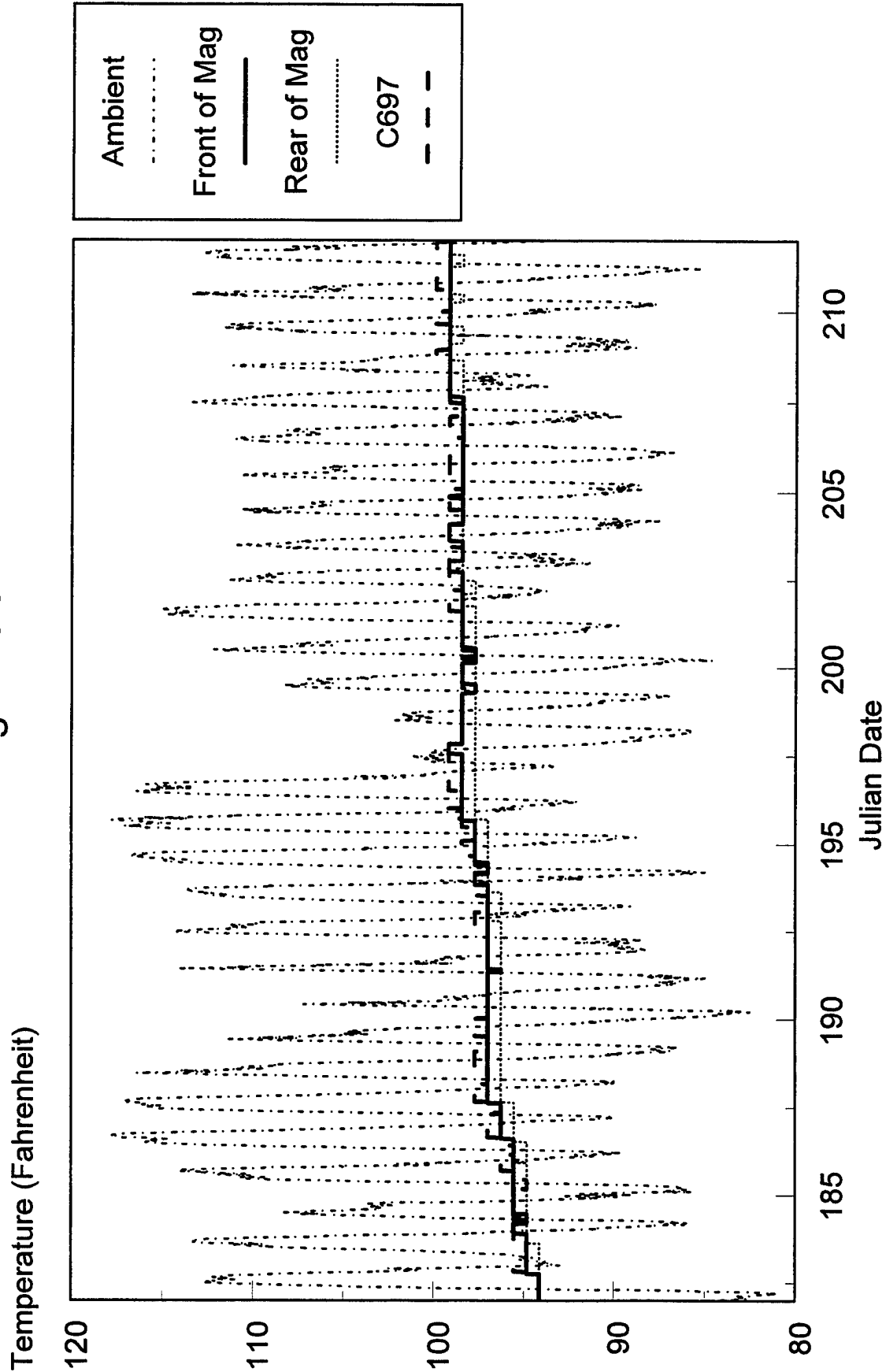
August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



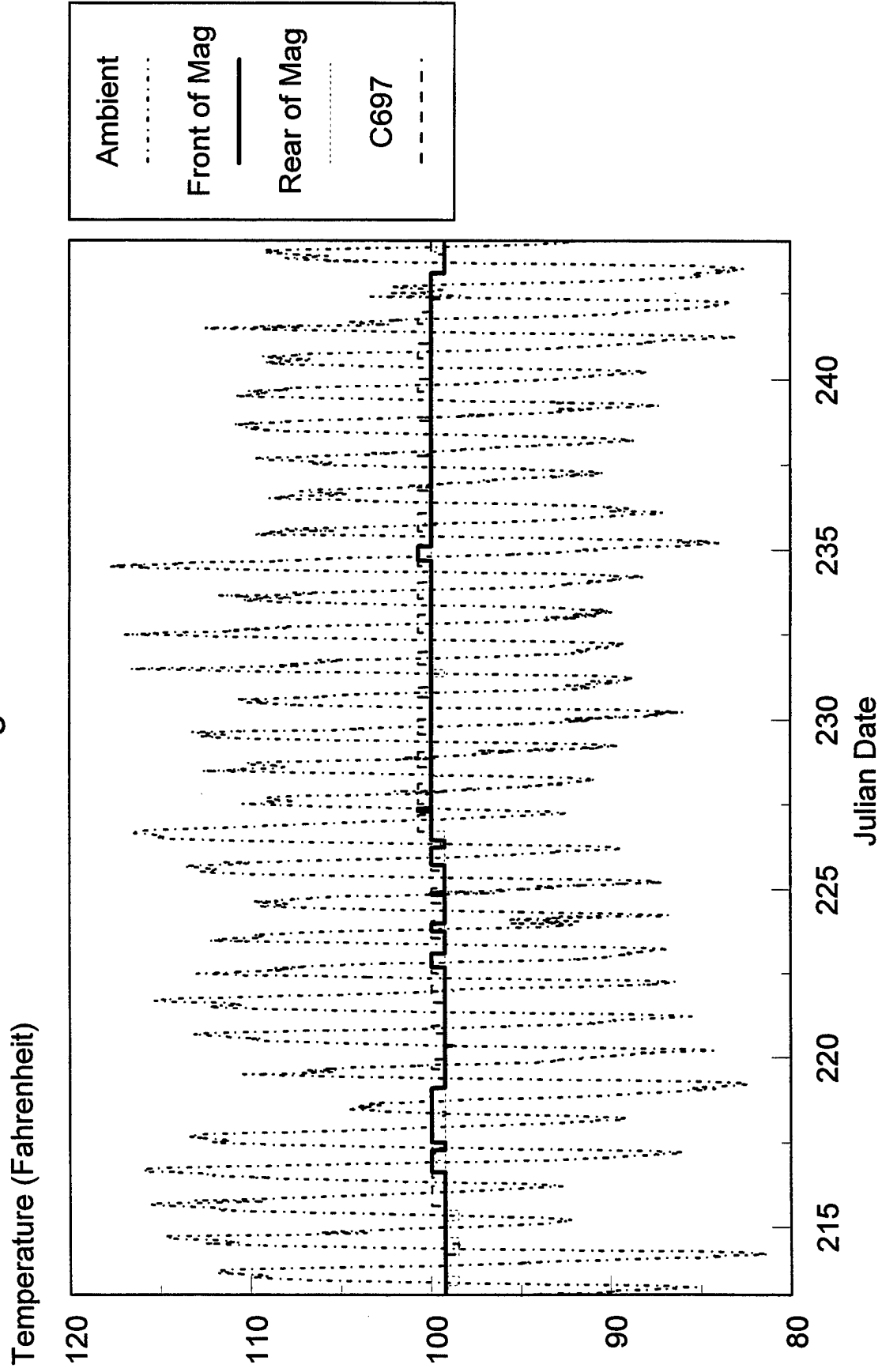
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



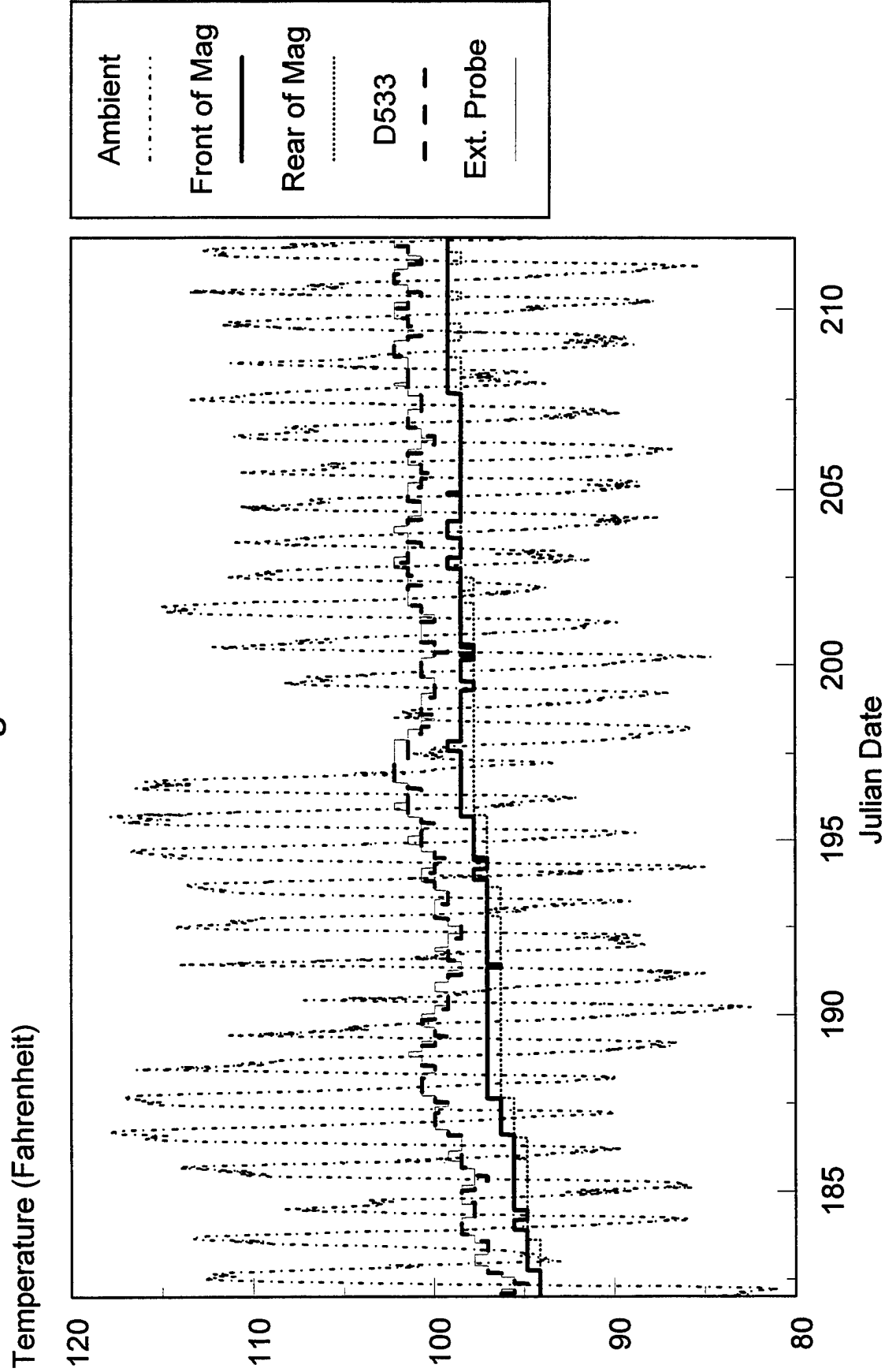
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



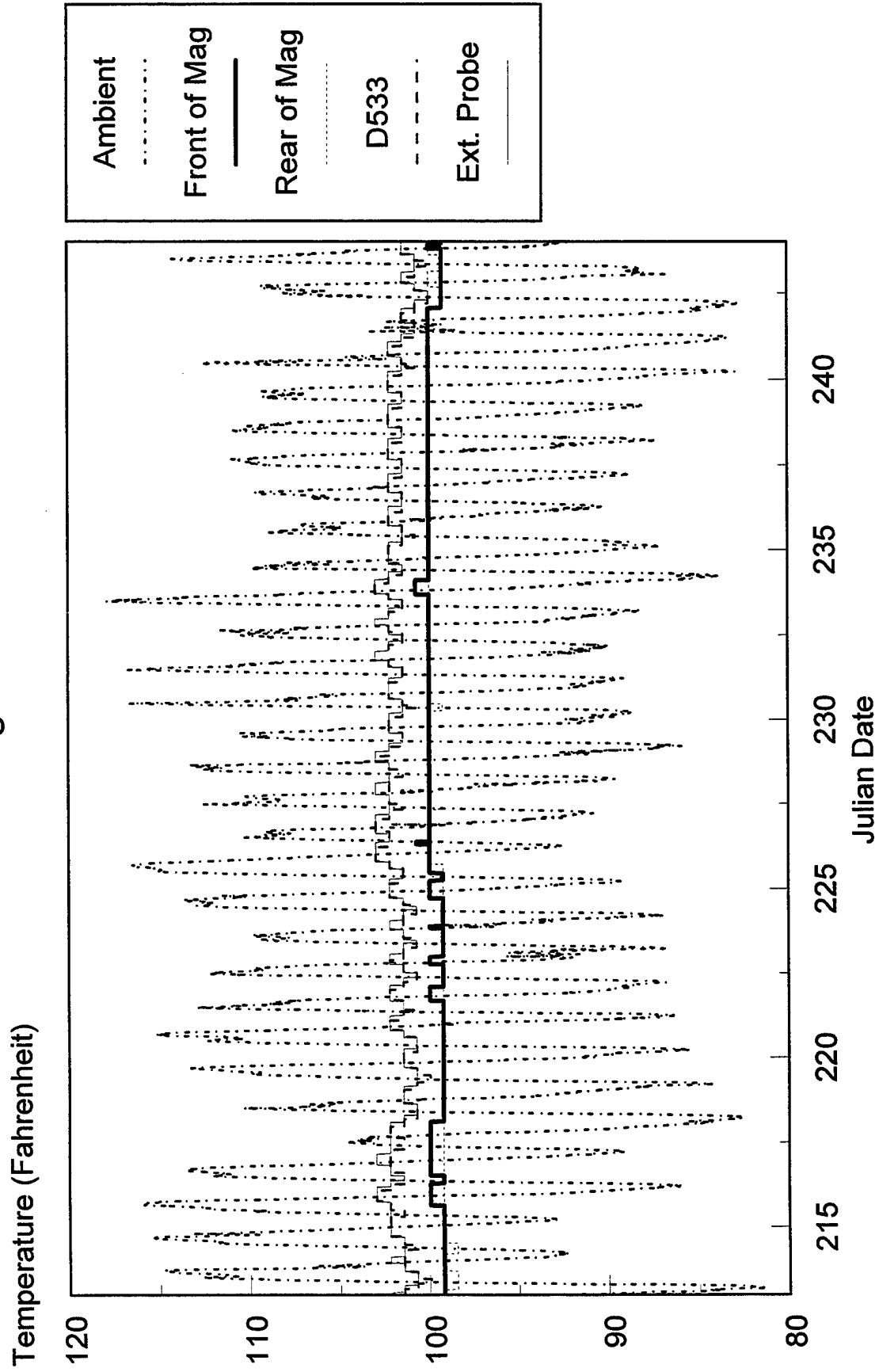
August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



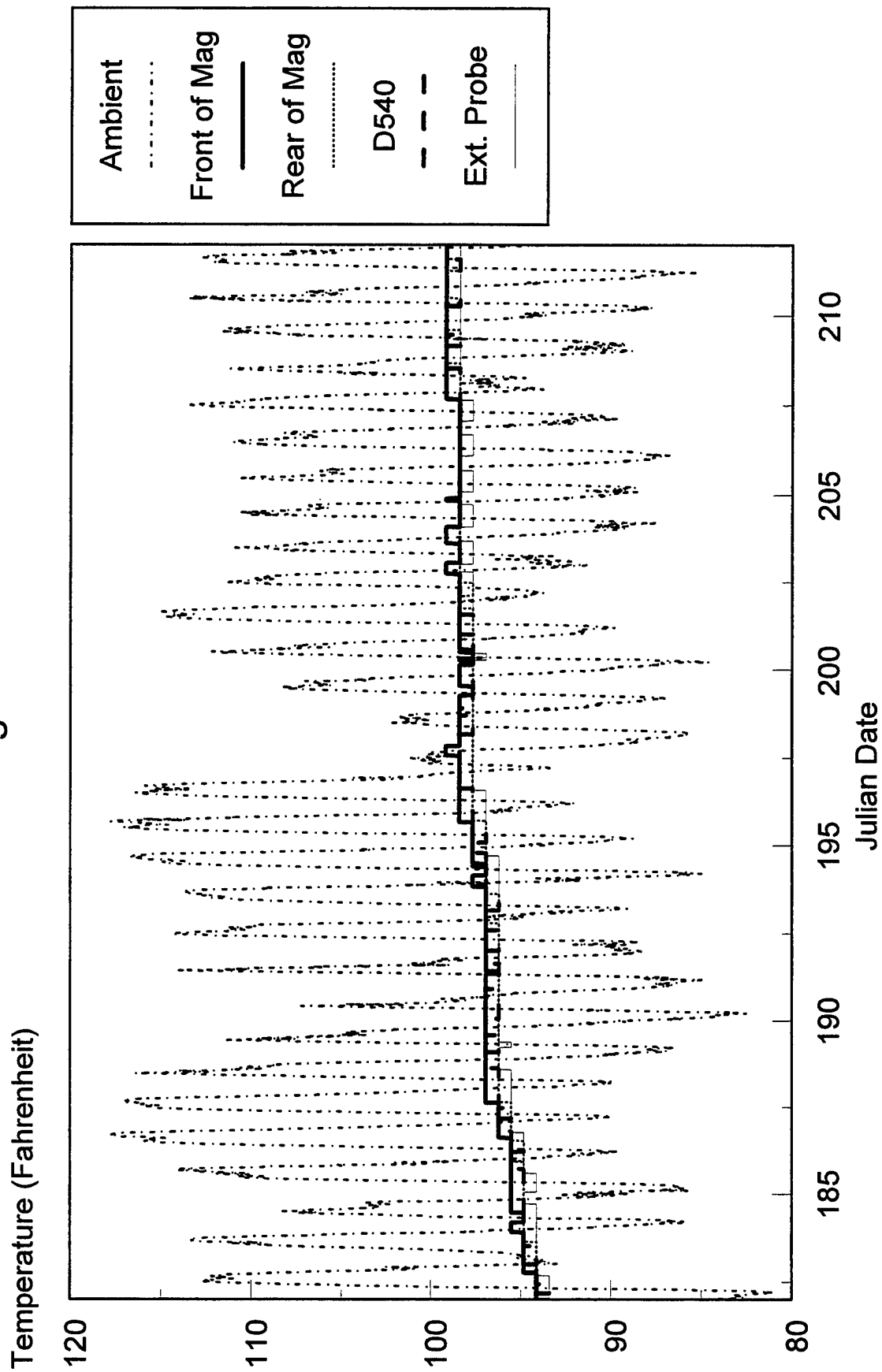
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



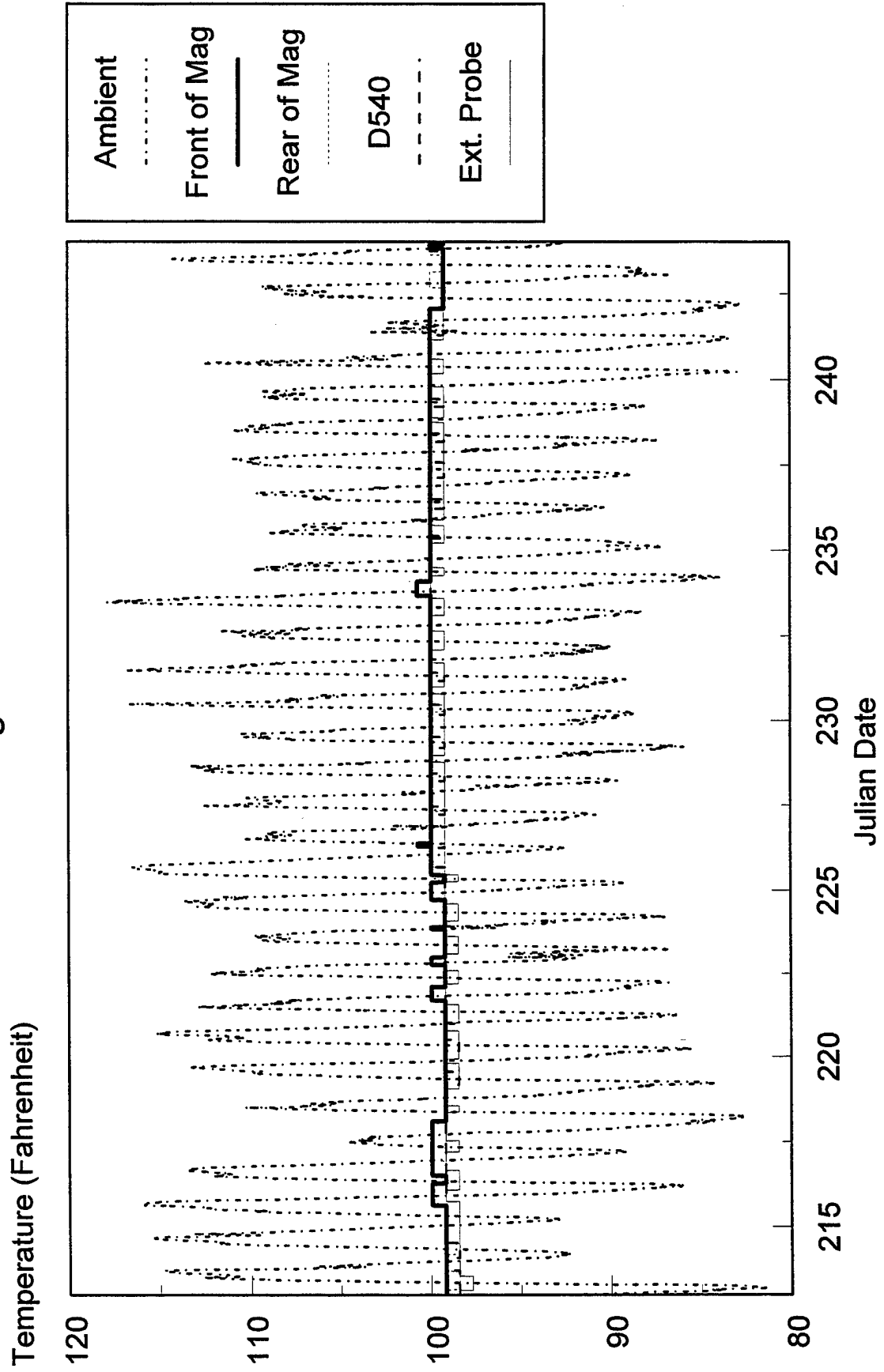
August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



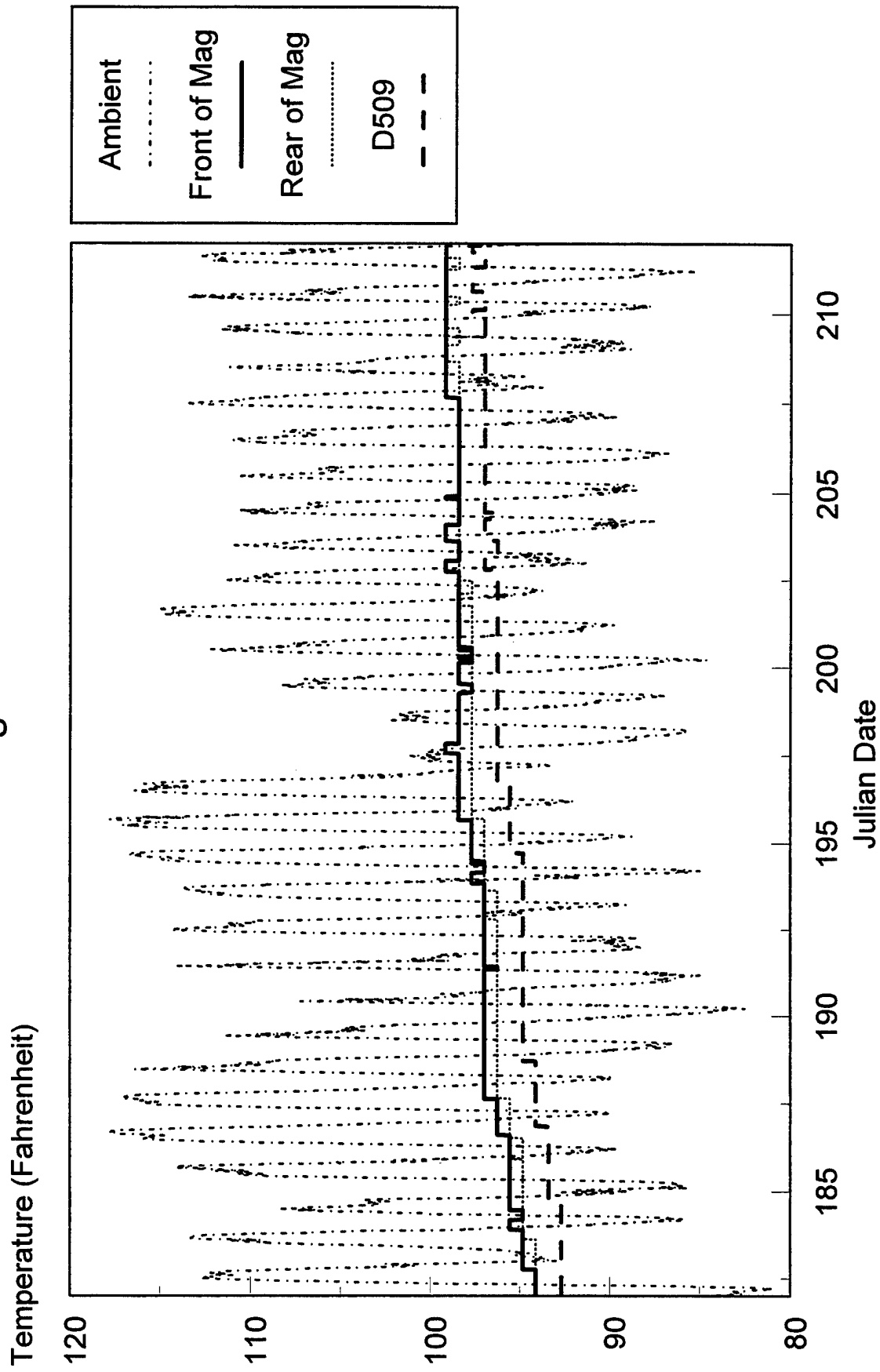
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



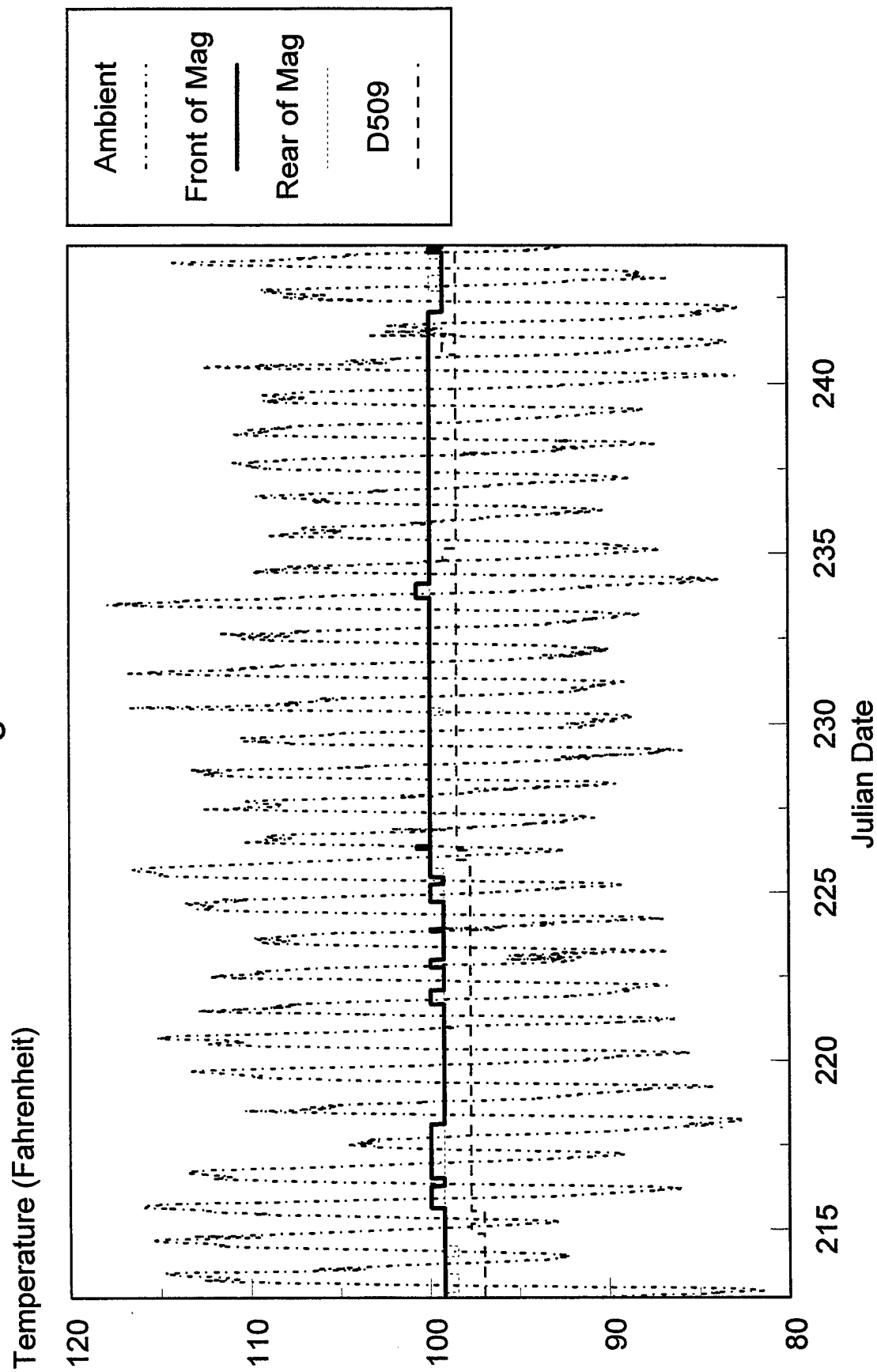
August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



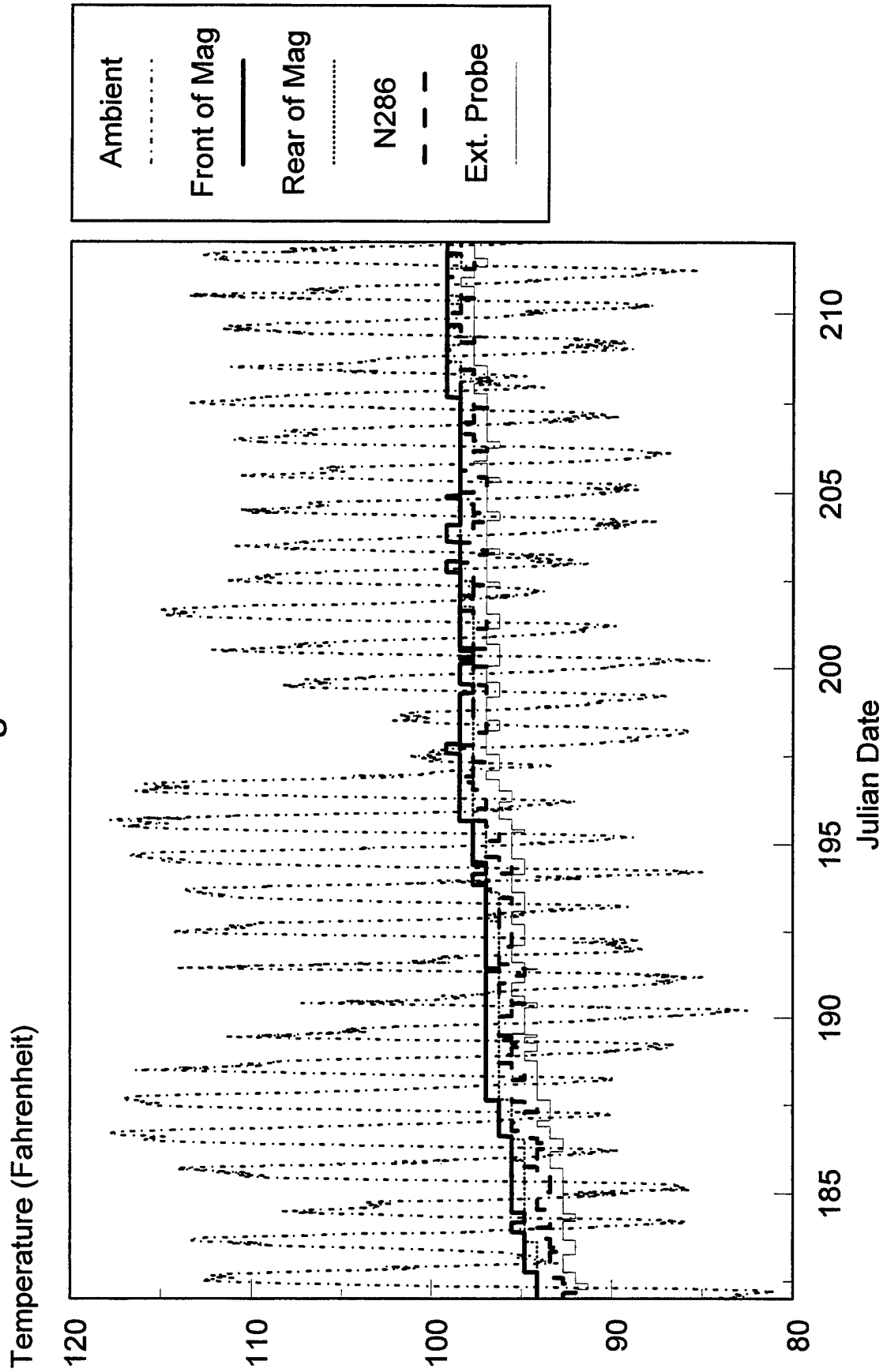
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



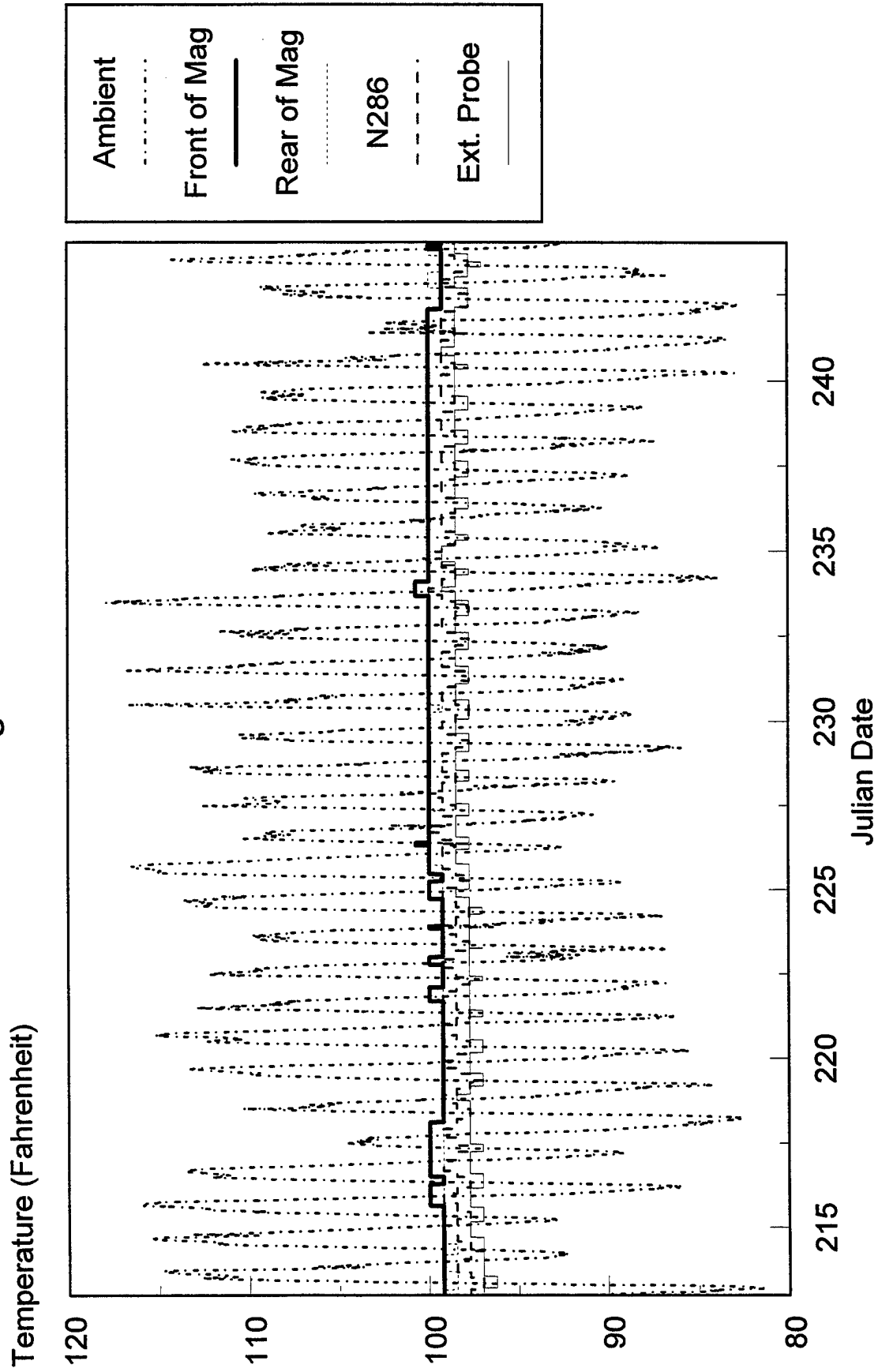
August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



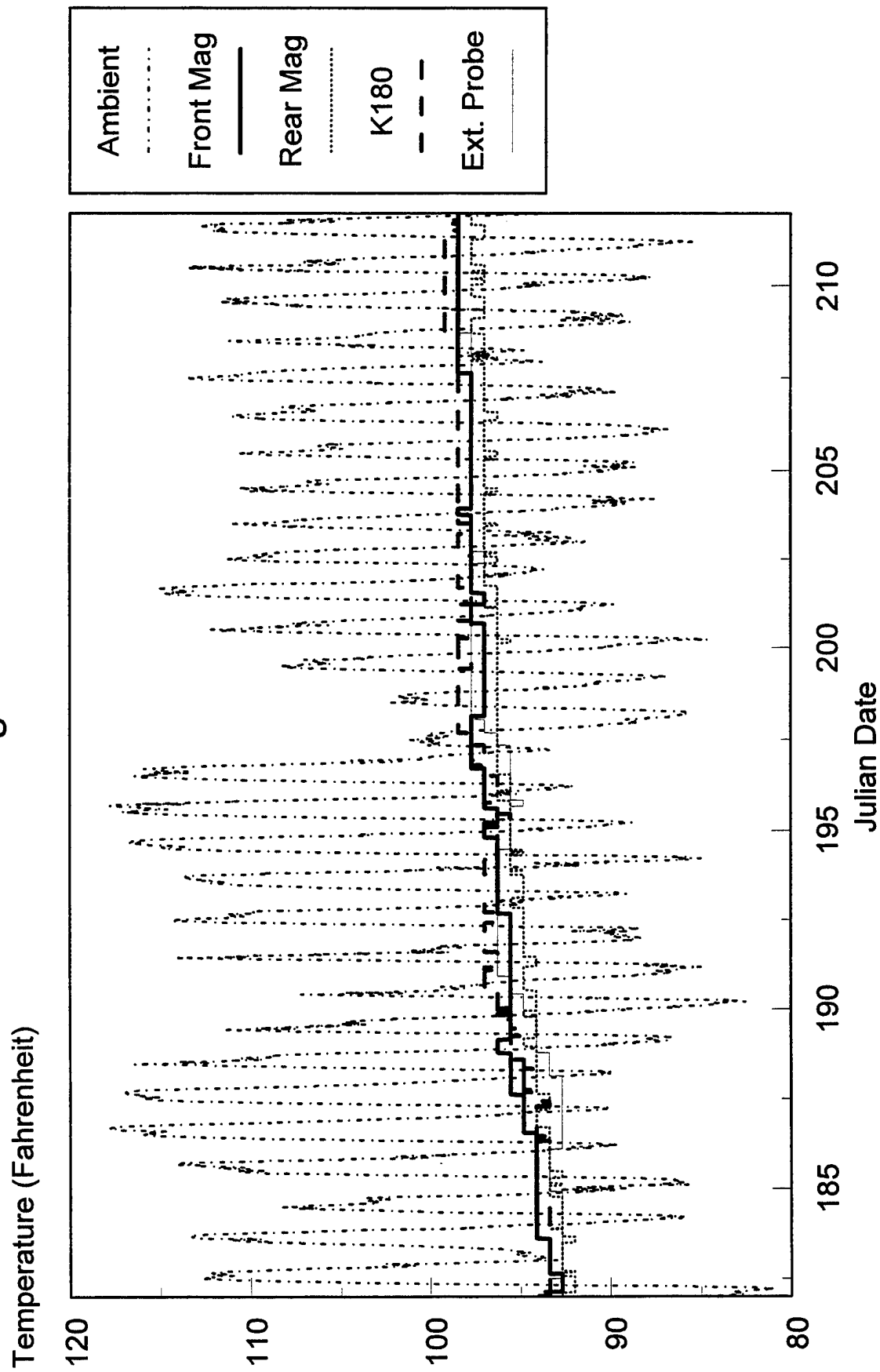
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



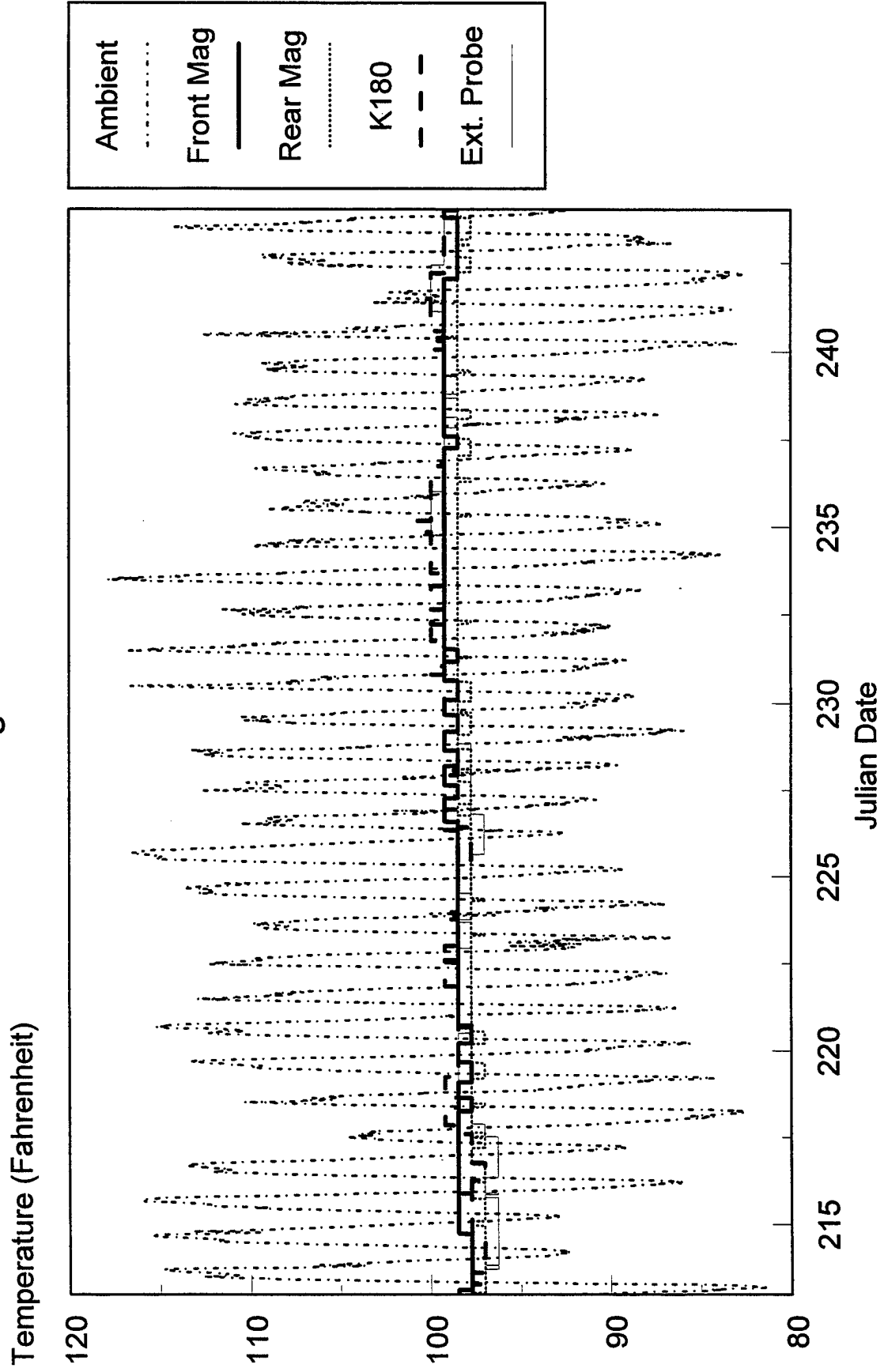
August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 5



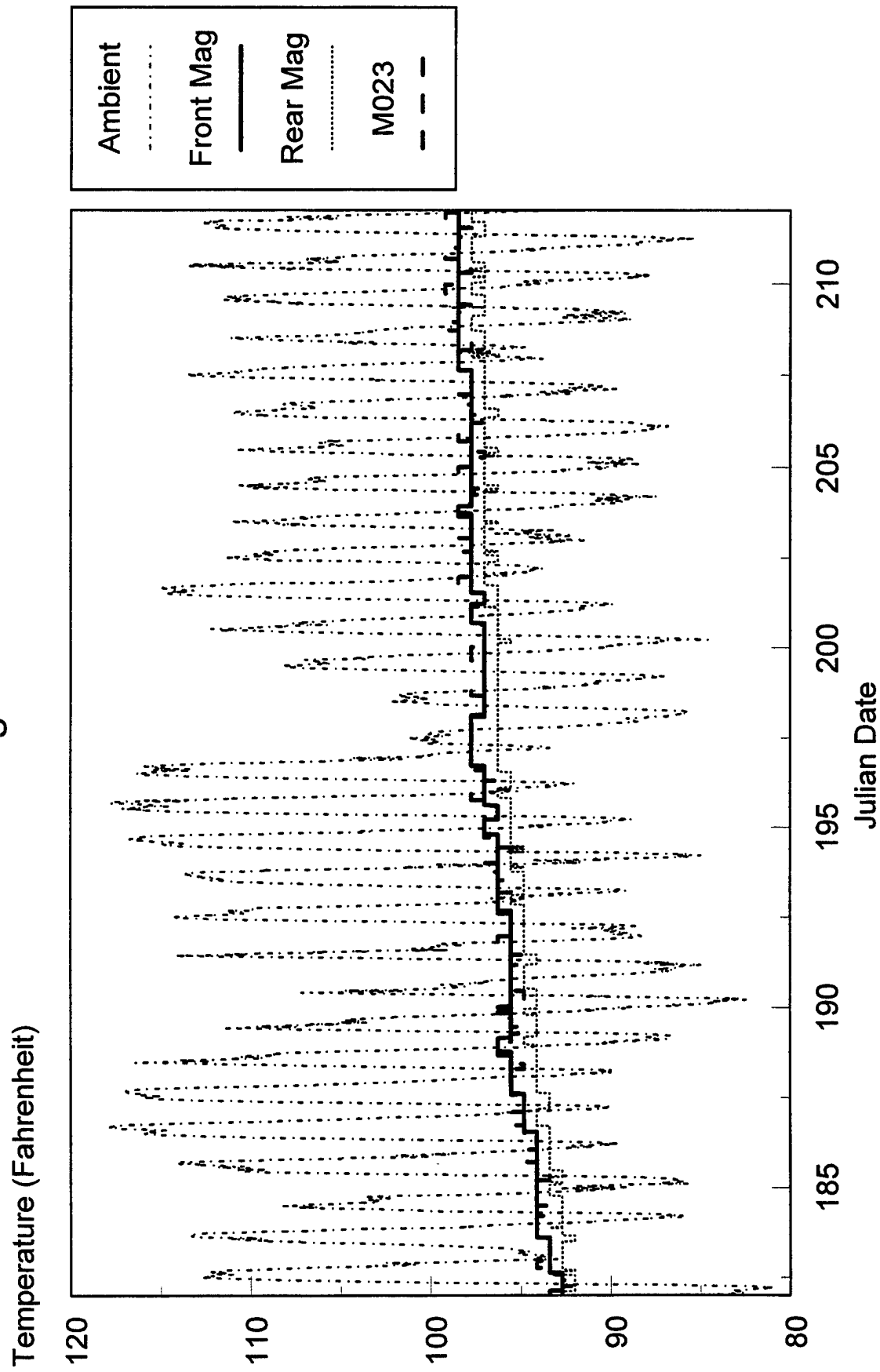
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 6



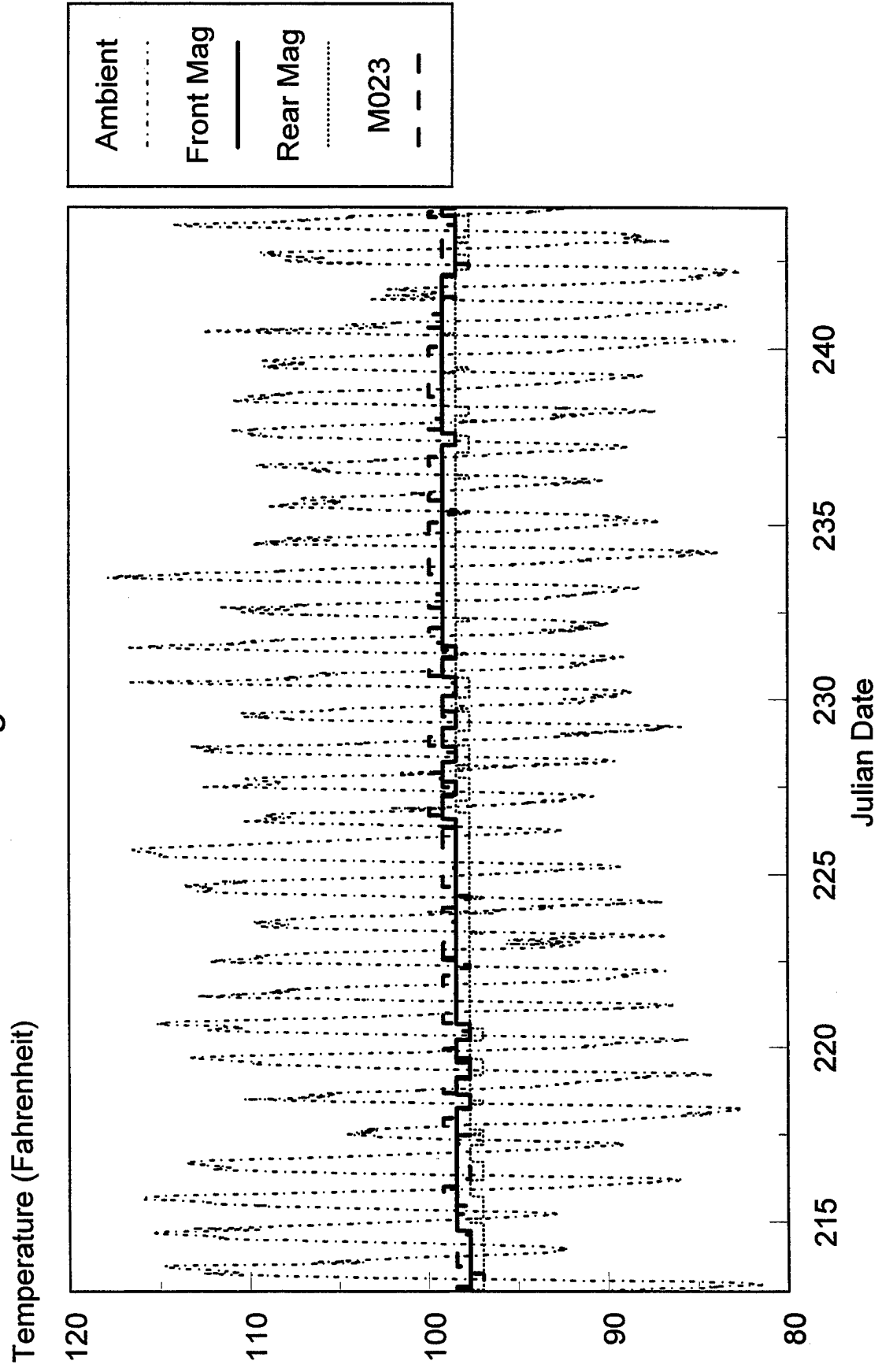
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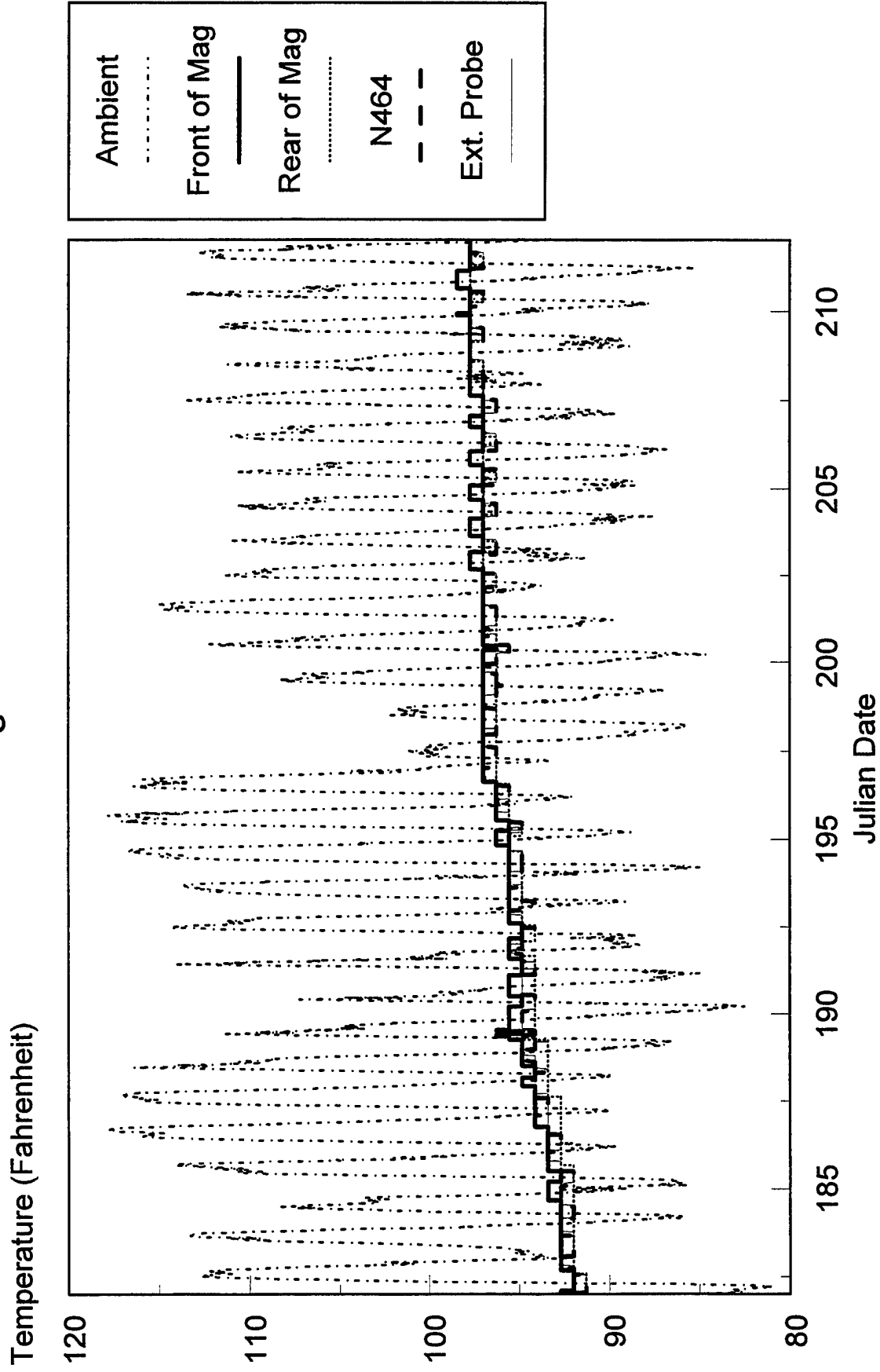
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 6



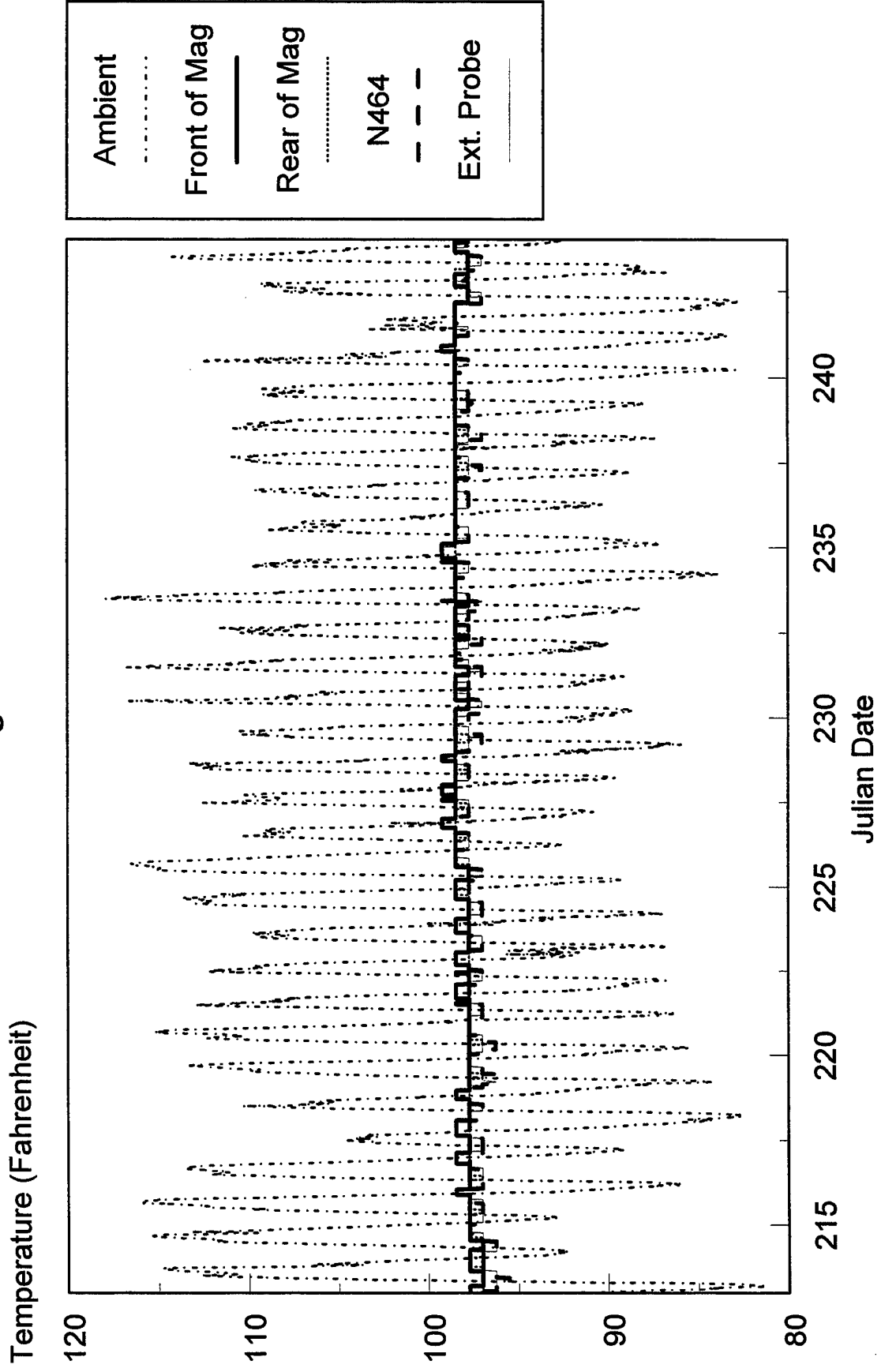
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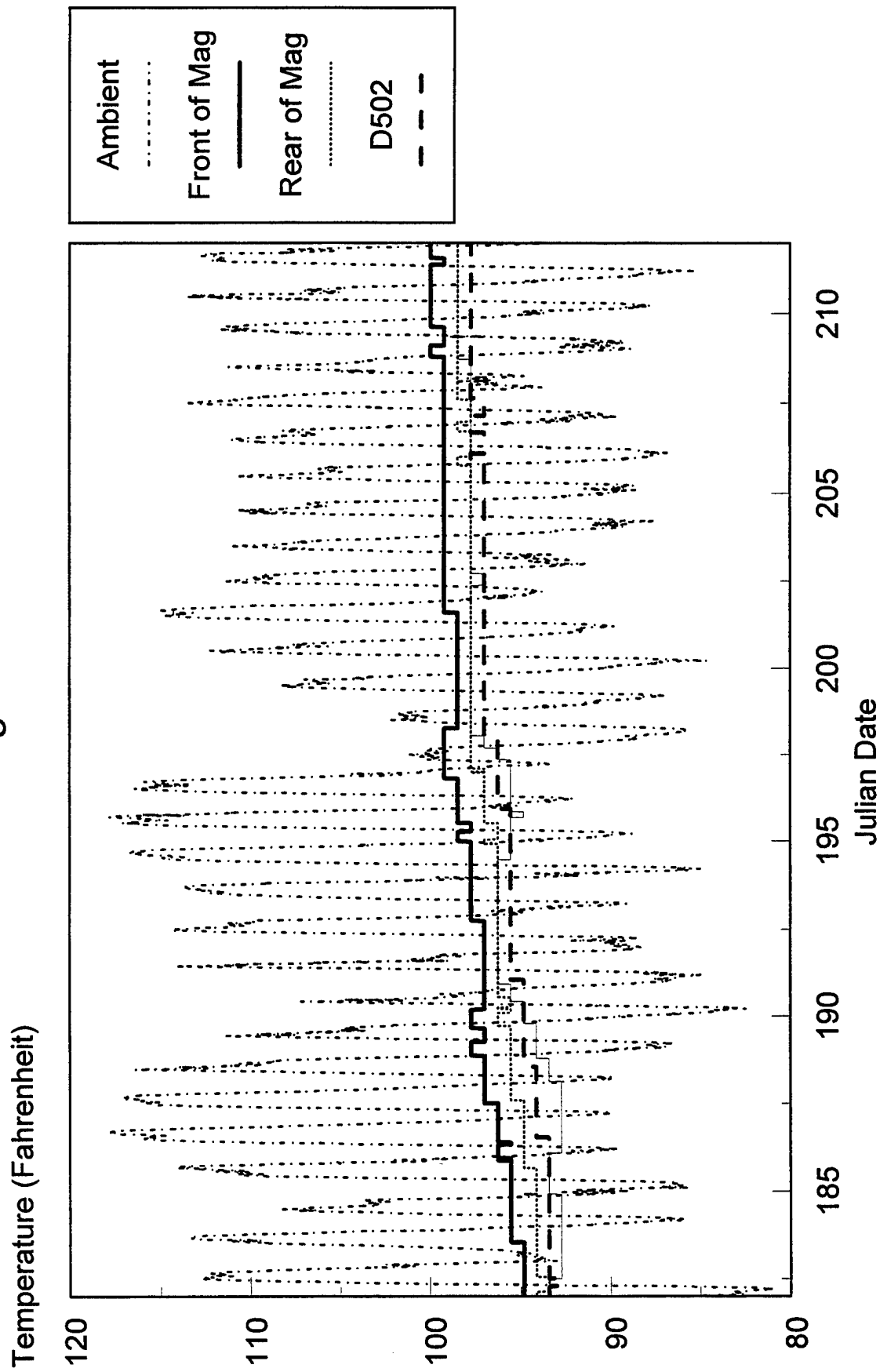
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 7



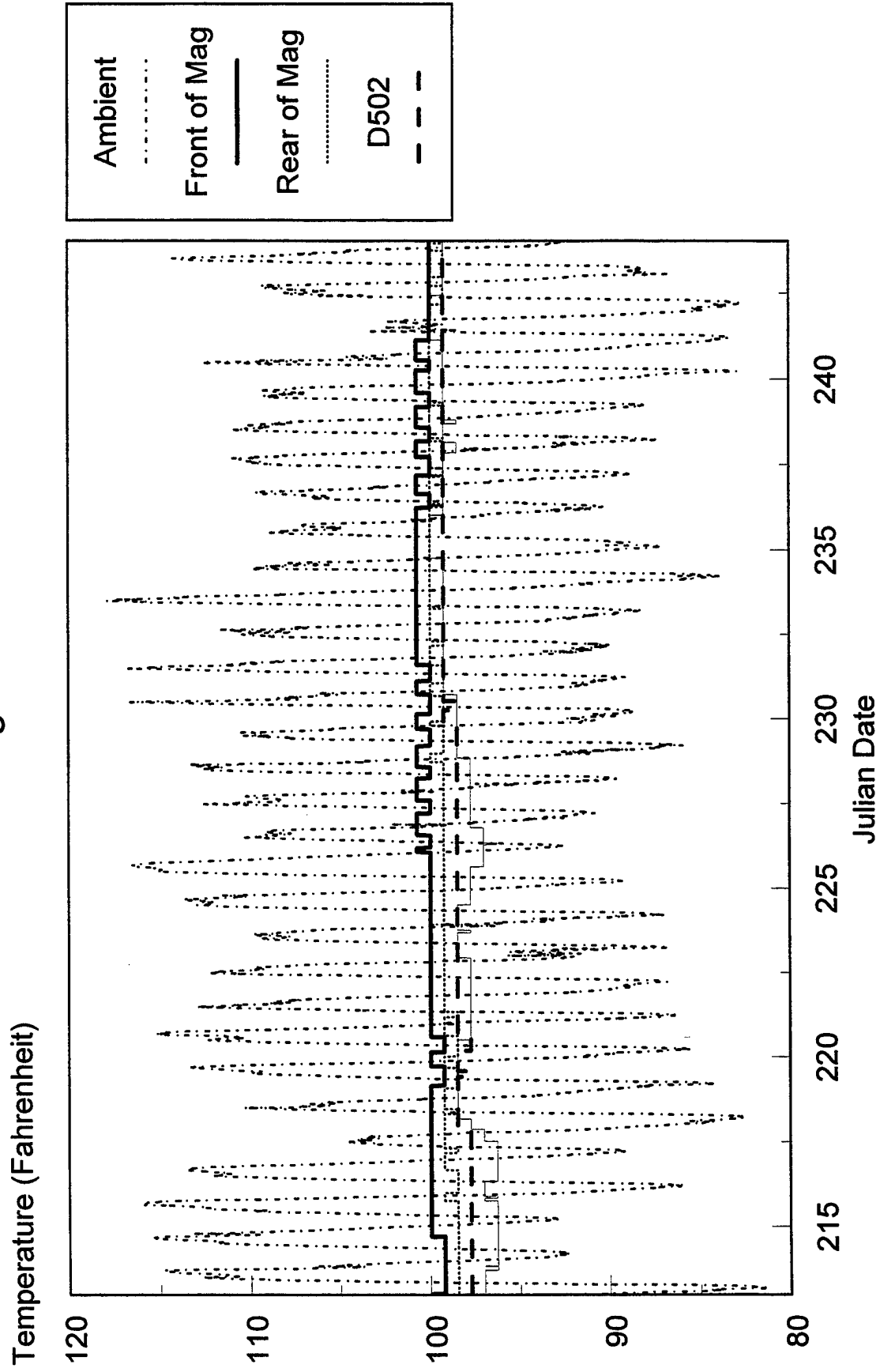
August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 7



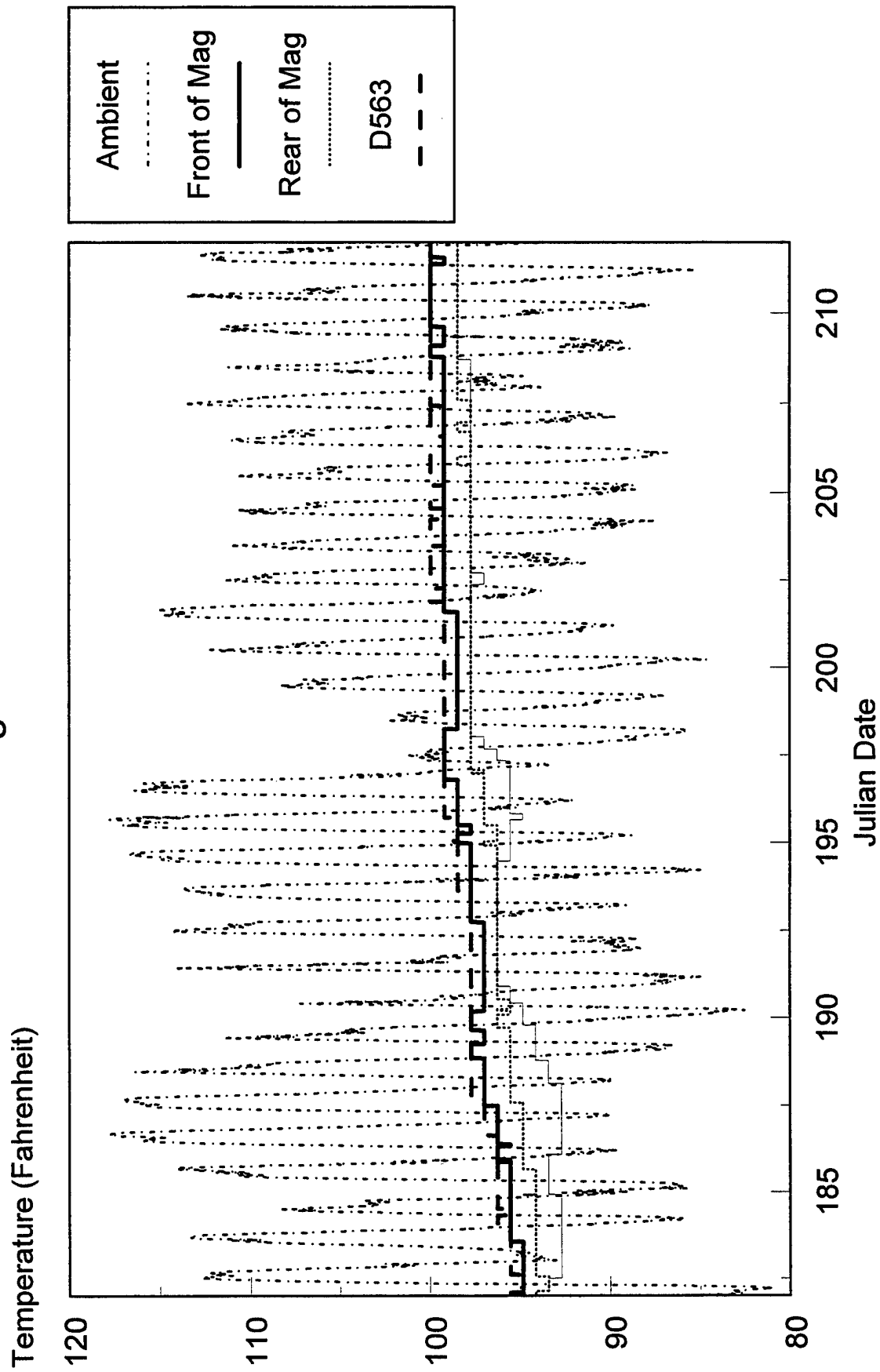
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 8



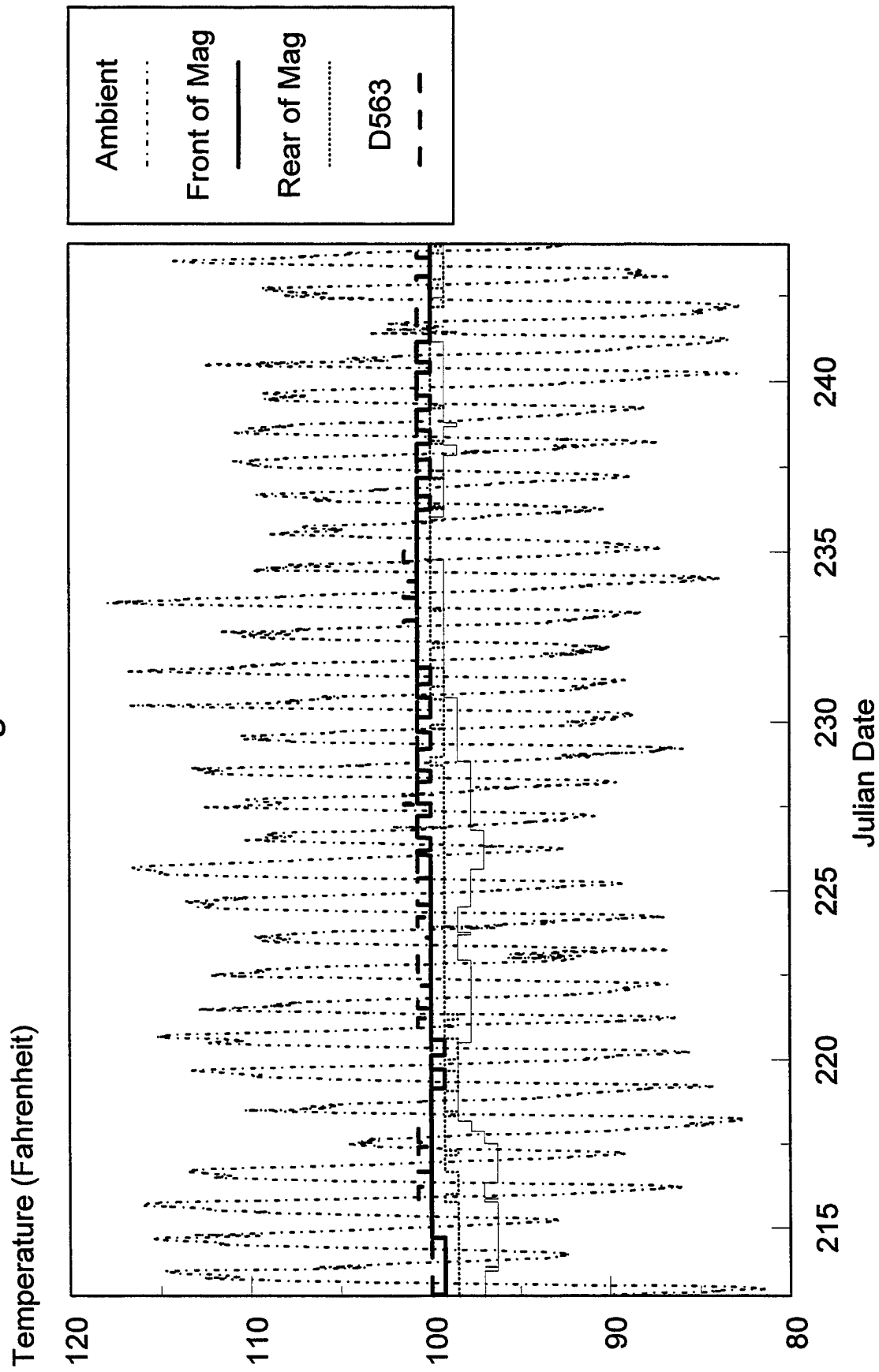
August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 8



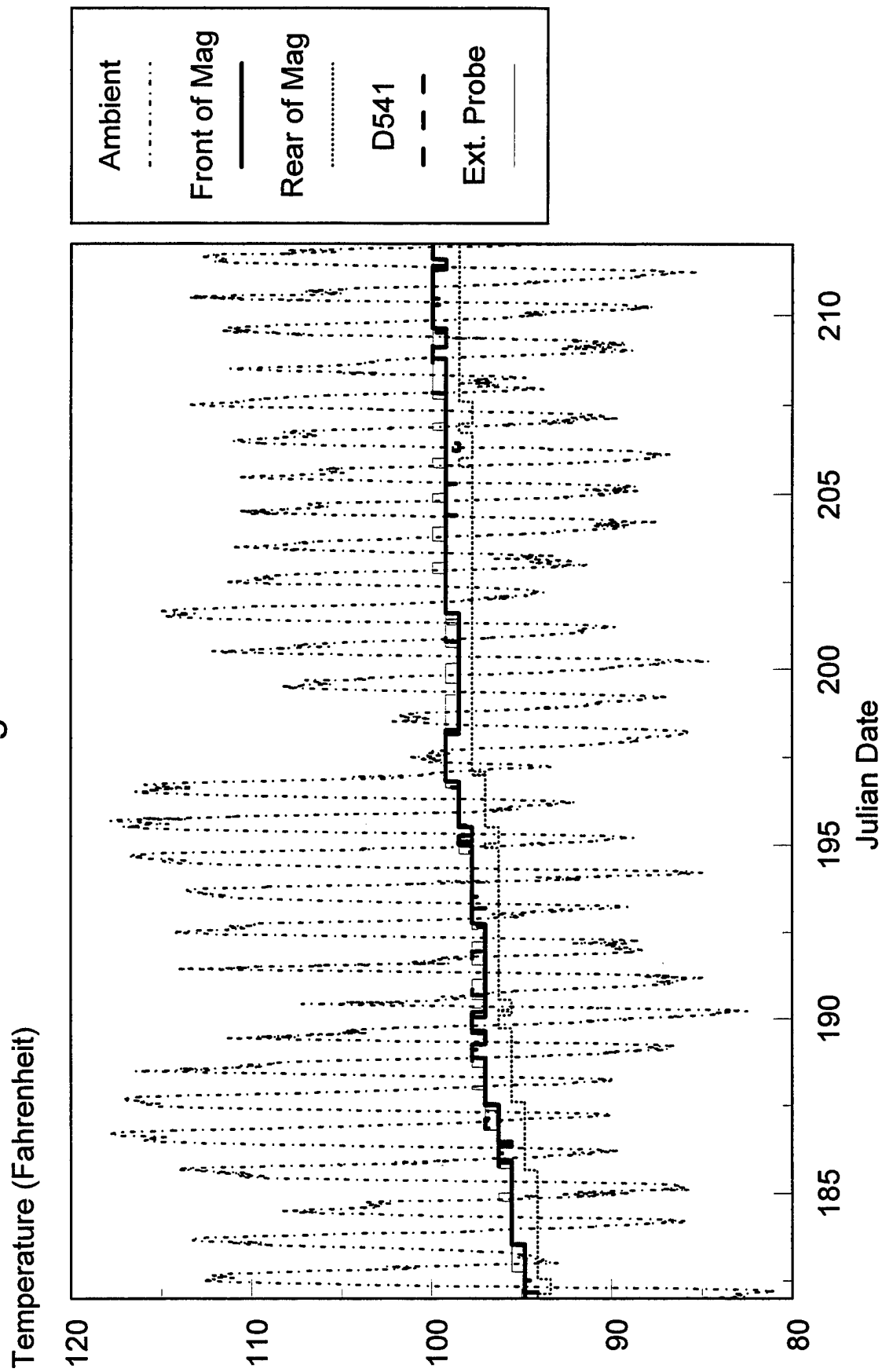
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 8



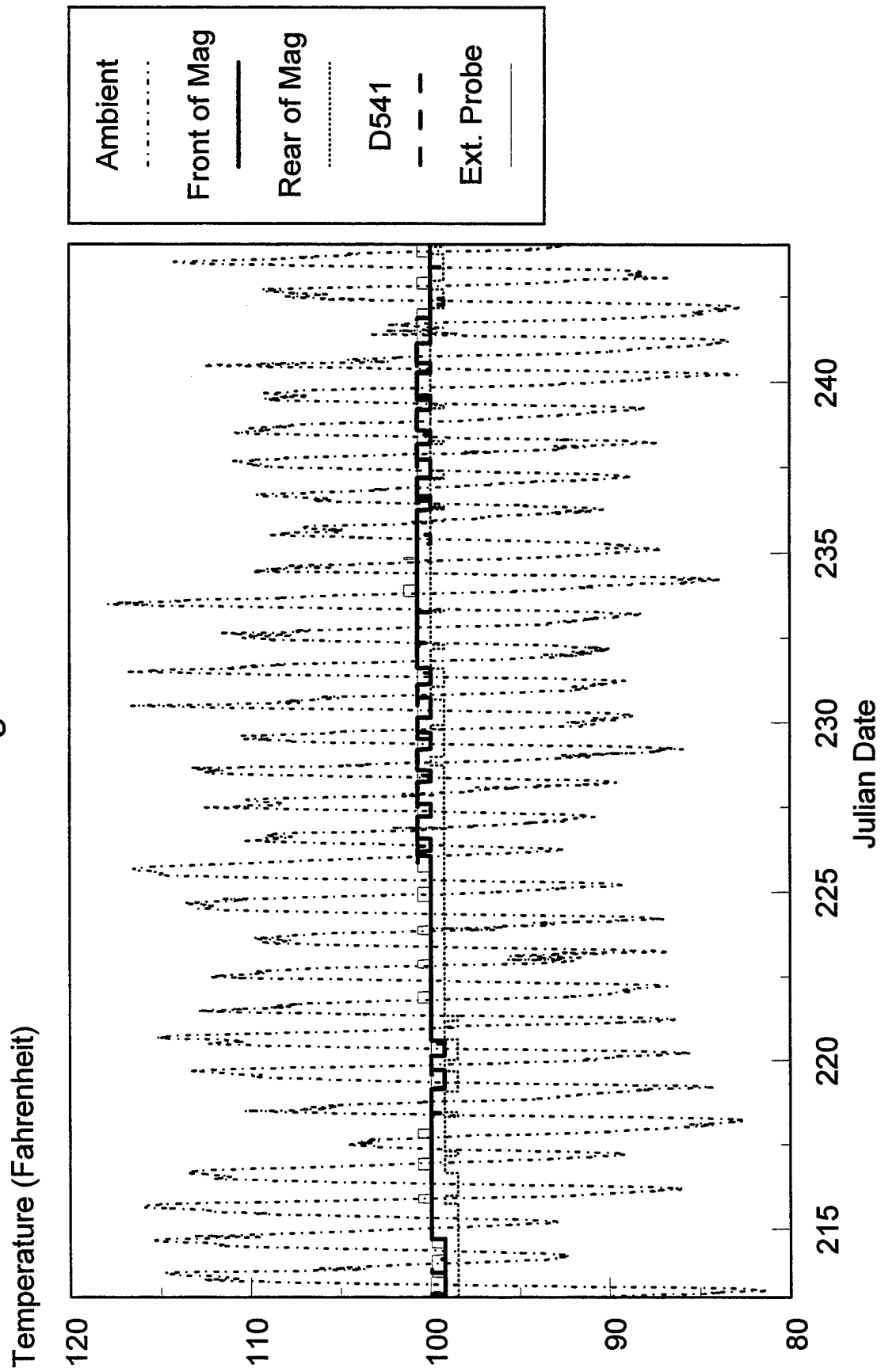
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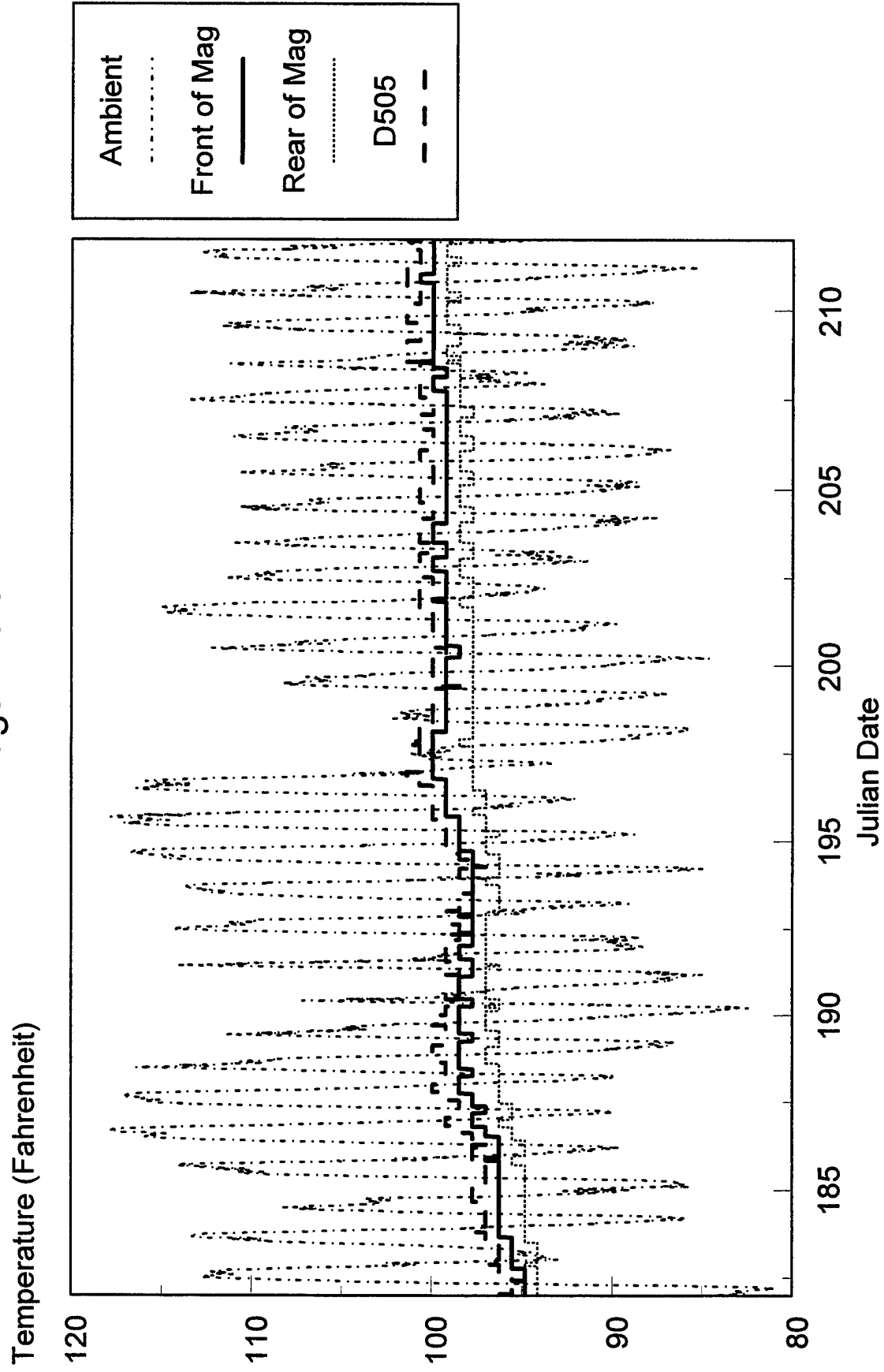
July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 8



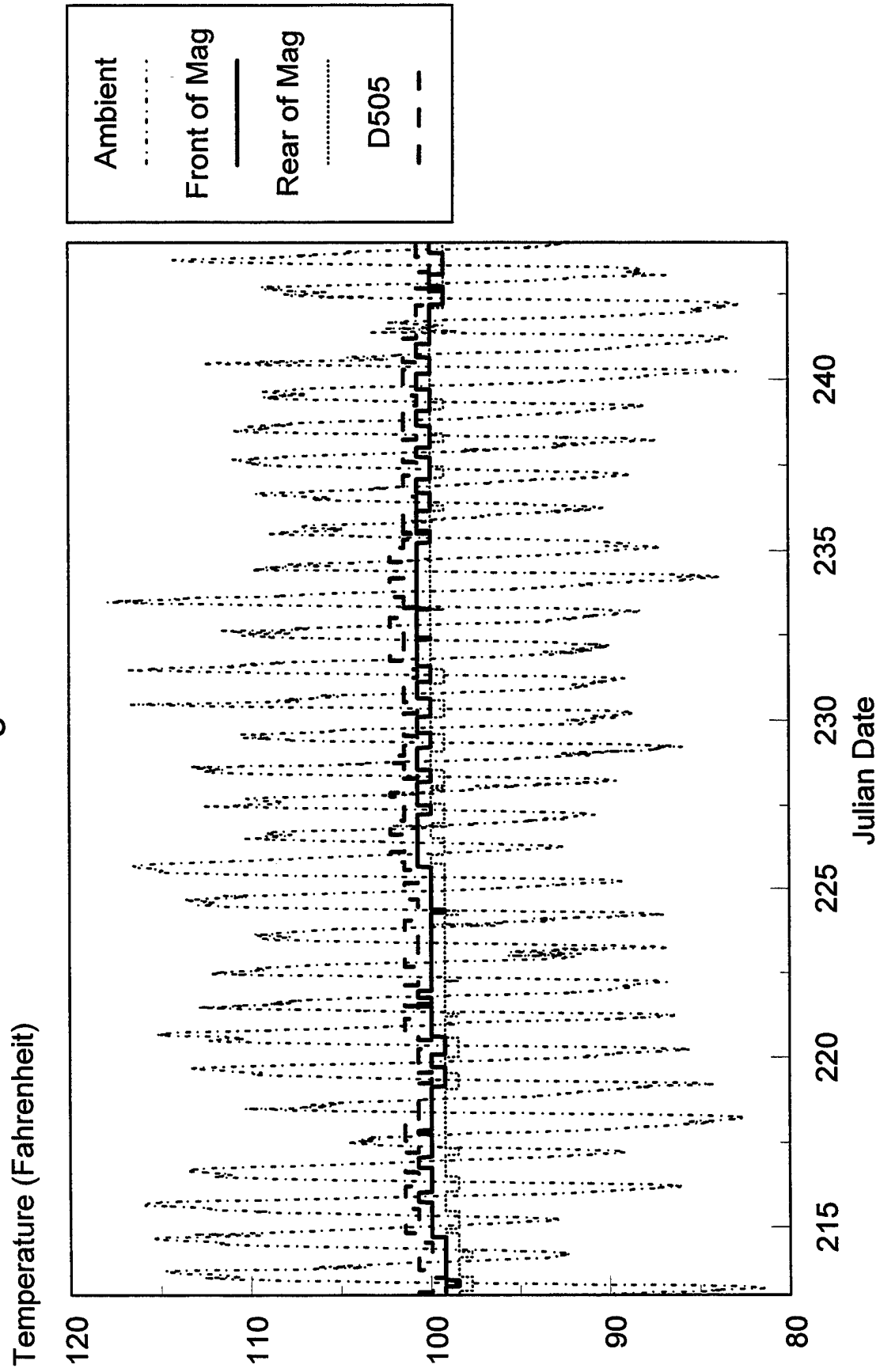
August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 8



July 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 9



August 1996 Environmental Monitoring of Ammo Stored at Kuwait Magazine 9



PART 8

APPENDIX

<u>Filename</u>	<u>Location</u>	<u>DODIC</u>	<u>LOT</u>	<u>ACTIVE</u>
<u>Milvan H3DA</u>				
54	Temp, top of Milvan H3DA			DEAD-ON-ARRIVAL
54	Humidity, top of Milvan H3DA			DEAD-ON-ARRIVAL
54	Int. Temp, top of Milvan H3DA			DEAD-ON-ARRIVAL
8840460	Temp, top of load Milvan H4B			10/22 - 03/20/96
8840461	Humidity, top of load Milvan H4B			10/22 - 03/20/96
<u>Milvan 7</u>				
2440460	Temp, 6" from top of Milvan 7			10/22 - 03/20/96
2440461	Humidity, 6" from top of Milvan 7			10/22 - 03/20/96
<u>Milvan 25</u>				
K640360	Temp, top of load Milvan 25	A589	SOD-L-500-30	10/22 - 03/20/96
K640361	Humidity, top of load Milvan 25	A589	SOD-L-500-30	10/22 - 03/20/96
K640362	Int. Temp, top of load Milvan 25	A589	SOD-L-500-30	10/22 - 03/20/96
<u>Milvan 97</u>				
7440360	Temp, 6" below top Milvan 97			10/22 - 03/20/96
7440361	Humidity, 6" below top of Milvan 97			10/22 - 03/20/96
<u>Milvan 302</u>				
8740460	Temp, 6" below top Milvan 210	D544	IOP-43-77	10/22 - 03/20/96
8740461	Humidity, 6" below top Milvan 210	D544	IOP-43-77	10/22 - 03/20/96
<u>Milvan 306</u>				
2640460	Temp, top of load Milvan 306	N285	HAT90H033-008	10/22 - 03/20/96
2640461	Humidity, top of load Milvan 306	N285	HAT90H033-008	10/22 - 03/20/96

2640462	Int. Temp, top of load Milvan 306	N285	HAT90H033-008	10/22 - 03/20/96
<u>Milvan 307</u>				
6740460	Temp, top of load Milvan 210	D544	IOP-43-77	10/22 - 03/20/96
6740461	Humidity, Top of load Milvan 210	D544	IOP-43-77	10/22 - 03/20/96
<u>Milvan 334</u>				
08040460	Temp, 6" from top Milvan 334			10/22 - 03/20/96
08040461	Humidity, 6" from top Milvan 334			10/22 - 03/20/96
8540460	Temp, Top of load Milvan 334	D528	PB-90A008-063	10/22 - 03/20/96
8540461	Humidity, Top of load Milvan 334	D528	PB-90A008-063	10/22 - 03/20/96
<u>Milvan 338</u>				
42340460	Temp, Top of load Milvan 338	D550	RD-24-18A	10/22 - 03/20/96
42340461	Humidity, Top of load Milvan 338	D550	RD-24-18A	10/22 - 03/20/96
<u>Milvan 411</u>				
84	Temp, top of Milvan 411			DEAD-ON-ARRIVAL
84	Humidity, top of Milvan 411			DEAD-ON-ARRIVAL
38340460	Temp, 6" from top Milvan 411			10/22 - 03/20/96
38340461	Humidity, 6" from top Milvan 411			10/22 - 03/20/96
<u>Milvan 423</u>				
16	Temp, top of load Milvan 411	D570	IOP-2-17	LOGGER LOST
16	Humidity, top of load Milvan 411	D570	IOP-2-17	LOGGER LOST
16	Int. temp, Top of load Milvan 411	D570	IOP-2-17	LOGGER LOST

Magazine 5

10940260	Temp, Front of Magazine 5			10/22 - 03/20/96
10940261	Humidity, Front of Magazine 5			10/22 - 03/20/96
11940260	Temp, Rear of Magazine 5			10/22 - 03/20/96
11940261	Humidity, Front of Magazine 5			10/22 - 03/20/96
5140260	Temp, Left G Magazine 5	C787	MHM90M024007	10/22 - 03/20/96
5140261	Humidity, Left G Magazine 5	C787	MHM90M024007	10/22 - 03/20/96
5140262	Int. Temp, Left G Magazine 5	C787	MHM90M024007	10/22 - 03/20/96
7840260	Temp, Left C Magazine 5	D540	IND87D-070752	10/22 - 03/20/96
7840261	Humidity, Left C Magazine 5	D540	IND87D-070752	10/22 - 03/20/96
7840262	Int. Temp, Left C Magazine 5	D540	IND87D-070752	10/22 - 03/20/96
6940360	Temp, Right E Magazine 5	D533	IND82B-070105	10/22 - 03/20/96
6940361	Humidity, Right E Magazine 5	D533	IND82B-070105	10/22 - 03/20/96
5840360	Temp, Right C Magazine 5	PD62	HAQ-3159-5BY	10/22 - 03/20/96
5840361	Humidity, Right C Magazine 5	PD62	HAQ-3159-5BY	10/22 - 03/20/96
5840362	Ext. Temp, Right C Magazine 5	PD62	HAQ-3159-5BY	10/22 - 03/20/96
37940260	Temp, Left A Magazine 5	D509	IOP87C230-004	10/22 - 03/20/96
37940261	Humidity, Left A Magazine 5	D509	IOP87C230-004	10/22 - 03/20/96
5740360	Temp, Magazine 5	C786	IOP87B072-002	10/22 - 03/20/96
5740361	Humidity, Magazine 5	C786	IOP87B072-002	10/22 - 03/20/96
5740362	Ext Temp, Magazine 5	C786	IOP87B072-002	10/22 - 03/20/96
<u>Magazine 6</u>				
42440360	Temp, Front of Magazine 6			10/22 - 03/20/96
42440361	Humidity, Front of Magazine 6			10/22 - 03/20/96

40040360	Temp, Rear of Magazine 6			10/22 - 03/20/96
40040361	Humidity, Front of Magazine 6			10/22 - 03/20/96
K2540360	Temp, Right G Magazine 6	K180	RVA-15-39	02/27 - 03/20/96
K2540361	Humidity, Right G Magazine 6	K180	RVA-15-39	02/27 - 03/20/96
K2440460	Temp, Left E Magazine 6	M023	LOP89H016-003	10/22 - 03/20/96
K2440461	Humidity, Left E Magazine 6	M023	LOP89H016-003	10/22 - 03/20/96
K2440462	Int. Temp, Left E Magazine 6	M023	LOP89H016-003	10/22 - 03/20/96
7540360	Temp, Left E Magazine 6	M032	KNK3-287	10/22 - 03/20/96
7540361	Humidity, Left E Magazine 6	M032	KNK3-287	10/22 - 03/20/96
7540362	Int. Temp, Left E Magazine 6	M032	KNK3-287	10/22 - 03/20/96
<u>Magazine 7</u>				
06540360	Temp, Front of Magazine 7			10/22 - 03/20/96
06540361	Humidity, Front of Magazine 7			10/22 - 03/20/96
33740360	Temp, Rear of Magazine 7			10/22 - 03/20/96
33740361	Humidity, Front of Magazine 7			10/22 - 03/20/96
6140360	Temp, Top of load Magazine 7	N286	MA-86A005-016	DEAD ON ARRIVAL
6140361	Humidity, Top of load Magazine 7	N286	MA-86A005-016	DEAD ON ARRIVAL
6140362	Int. Temp, Top of load Magazine 7	N286	MA-86A005-016	DEAD ON ARRIVAL
7451240	Temp, Left C Magazine 7	N464	LS-82M011-003	DEAD ON ARRIVAL
7451241	Humidity, Left C Magazine 7	N464	LS-82M011-003	DEAD ON ARRIVAL
7451240	Int. Temp, Left C Magazine 7	N464	LS-82M011-003	DEAD ON ARRIVAL
6840360	Temp, Left D Magazine 7	N340	MA-80M002-001	10/22 - 03/20/96
6840361	Humidity, Left D Magazine 7	N340	MA-80M002-001	10/22 - 03/20/96
6840362	Int. Temp, Left D Magazine 7	N340	MA-80M002-001	10/22 - 03/20/96

Magazine 8

365404060	Temp, Front of Magazine 8			10/22 - 03/20/96
365404061	Humidity, Front of Magazine 8			10/22 - 03/20/96
074404060	Temp, Front of Magazine 8			10/22 - 03/20/96
074404061	Humidity, Front of Magazine 8			10/22 - 03/20/96
394404060	Temp, Right A Magazine 8	D563	MA-88H010-003A	10/22 - 03/20/96
394404061	Humidity, Right A Magazine 8	D563	MA-88H010-003A	10/22 - 03/20/96
430404060	Temp, left A Magazine 8	D502	LOP87D351-001	10/22 - 03/20/96
430404061	Humidity, left A Magazine 8	D502	LOP87D351-001	10/22 - 03/20/96
1740360	Temp, Left H Magazine 8	D541	IND92G-071641	10/22 - 03/20/96
1740361	Humidity, Left H Magazine 8	D541	IND92G-071641	10/22 - 03/20/96
1740362	Int. Temp, Left H Magazine 8	D541	IND92G-071641	10/22 - 03/20/96
<u>Magazine 9</u>				
373404060	Temp, Front of Magazine 9			10/22 - 03/20/96
373404061	Humidity, Front of Magazine 9			10/22 - 03/20/96
083404060	Temp, Rear of Magazine 9			10/22 - 03/20/96
083404061	Humidity, Front of Magazine 9			10/22 - 03/20/96
422404060	Temp, Right D Magazine 9	D505	LOW86C041	10/22 - 03/20/96
422404061	Humidity, Right D Magazine 9	D505	LOW86C041	10/22 - 03/20/96

MAGAZINE SPREADSHEET
H:\testdata\Kuwait96\stickon2\MAGAZINE

<u>Column</u>	<u>Description</u>	<u>Location</u>	<u>Active</u>
A	WX ID Number		09/16/96 - 12/31/96
B	Julian Date		09/16/96 - 12/31/96
C	Time		09/16/96 - 12/31/96
D	Wind Speed (MPH)		05/28/96 - 12/31/96
E	Wind Direction		05/28/96 - 07/31/96
F	Standard Deviation of Wind Direction		05/28/96 - 07/31/96
G	Ambient Temperature (12 feet above ground)		05/28/96 - 12/26/96
H	Ambient Humidity		05/28/96 - 12/26/96
I	Solar Radiation 350-1150nm		05/27/96 - 09/14/96
J	Solar Radiation 285-2800nm		05/27/96 - 09/14/96
K	Ambient Temperature (2.5 feet above ground)		05/28/96 - 12/26/96
L	Ground Surface Temperature		05/28/96 - 12/26/96
M	Battery Voltage		05/28/96 - 12/26/96
N	Temperature	Mag 4, C787, MHM90M024H007, Logger K3	05/28/96 - 12/26/96
O	Humidity	Mag 4, C787, MHM90M024H007, Logger K3	05/28/96 - 12/26/96
P	External Probe	Mag 4, C787, MHM90M024H007, Logger K3	05/28/96 - 12/26/96
Q	Temperature	Mag 4, C786, IOP87B072-002, Logger 86	05/28/96 - 12/26/96
R	Humidity	Mag 4, C786, IOP87B072-002, Logger 86	05/28/96 - 12/26/96
S	External Probe	Mag 4, C786, IOP87B072-002, Logger 86	05/28/96 - 12/26/96
T	Temperature	Mag 5, Ambient @ front of mag, Logger K10	05/28/96 - 12/26/96
U	Humidity	Mag 5, Ambient @ front of mag, Logger K10	05/28/96 - 12/26/96
V	Temperature	Mag 5, Ambient @ rear of mag, Logger 47	05/28/96 - 12/26/96
W	Humidity	Mag 5, Ambient @ rear of mag, Logger 47	05/28/96 - 12/26/96
X	Temperature	Mag 5, C787, MHM90M024H007, Logger K3	05/27/96 - 09/14/96
Y	Humidity	Mag 5, C787, MHM90M024H007, Logger K3	05/27/96 - 09/14/96
Z	External Probe	Mag 5, C787, MHM90M024H007, Logger K3	05/27/96 - 09/14/96
AA	Temperature	Mag 5, D533, IND82B-070105, Logger 77	05/28/96 - 12/26/96
AB	Humidity	Mag 5, D533, IND82B-070105, Logger 77	05/28/96 - 12/26/96
AC	External Probe	Mag 5, D533, IND82B-070105, Logger 77	05/28/96 - 12/26/96

AD	Temperature	Mag 5, D540, IND87D-070752, Logger 97	05/31/96 - 12/26/96
AE	Humidity	Mag 5, D540, IND87D-070752, Logger 97	05/31/96 - 12/26/96
AF	External Probe	Mag 5, D540, IND87D-070752, Logger 97	05/31/96 - 12/26/96
AG	Temperature	Mag 5, D509, IOP87C230-004, Logger K37	05/28/96 - 12/26/96
AH	Humidity	Mag 5, D509, IOP87C230-004, Logger K37	05/28/96 - 12/26/96
AI	Temperature	Mag 5, C697, LOP91F215-007, Logger 66	05/28/96 - 12/26/96
AJ	Humidity	Mag 5, C697, LOP91F215-007, Logger 66	05/28/96 - 12/26/96
AK	Temperature	Mag 5, N286, MA-88C008-001, Logger 81	05/28/96 - 12/26/96
AL	Humidity	Mag 5, N286, MA-88C008-001, Logger 81	05/28/96 - 12/26/96
AM	External Probe	Mag 5, N286, MA-88C008-001, Logger 81	05/28/96 - 12/26/96
AN	Temperature	Mag 6, Ambient @ front of mag, Logger 25	05/28/96 - 12/26/96
AO	Humidity	Mag 6, Ambient @ front of mag, Logger 25	05/28/96 - 12/26/96
AP	Temperature	Mag 6, Ambient @ rear of mag, Logger 92	05/31/96 - 12/26/96
AQ	Humidity	Mag 6, Ambient @ rear of mag, Logger 92	05/31/96 - 12/26/96
AR	Temperature	Mag 6, M023, LOP89H016-003, Logger 90	05/28/96 - 11/06/96
AS	Humidity	Mag 6, M023, LOP89H016-003, Logger 90	05/28/96 - 11/06/96
AT	External Probe	Mag 6, M023, LOP89H016-003, Logger 90	05/28/96 - 11/06/96
AU	Temperature	Mag 6, K180, RVA-15-39, Logger Q4	05/28/96 - 12/26/96
AV	Humidity	Mag 6, K180, RVA-15-39, Logger Q4	05/28/96 - 12/26/96
AW	External Probe	Mag 6, K180, RVA-15-39, Logger Q4	05/28/96 - 12/26/96
AX	Temperature	Mag 7, Ambient @ front of mag, Logger 52	05/28/96 - 12/27/96
AY	Humidity	Mag 7, Ambient @ front of mag, Logger 52	05/28/96 - 12/27/96
AZ	Temperature	Mag 7, Ambient @ rear of mag, Logger K16	05/28/96 - 12/27/96
BA	Humidity	Mag 7, Ambient @ rear of mag, Logger K16	05/28/96 - 12/27/96
BB	Temperature	Mag 7, N464, LS-82M011-003, Logger K32	05/28/96 - 12/27/96
BC	Humidity	Mag 7, N464, LS-82M011-003, Logger K32	05/28/96 - 12/27/96
BD	External Probe	Mag 7, N464, LS-82M011-003, Logger K32	05/28/96 - 12/27/96
BE	Temperature	Mag 7, N285, HAT90H033-008, Logger 27	09/12/96 - 12/27/96
BF	Humidity	Mag 7, N285, HAT90H033-008, Logger 27	09/12/96 - 12/27/96
BG	Temperature	Mag 8, Ambient @ front of mag, Logger 43	05/28/96 - 12/26/96
BH	Humidity	Mag 8, Ambient @ front of mag, Logger 43	05/28/96 - 12/26/96
BI	Temperature	Mag 8, Ambient @ rear of mag, Logger 73	05/28/96 - 12/26/96
BJ	Humidity	Mag 8, Ambient @ rear of mag, Logger 73	05/28/96 - 12/26/96

BK	Temperature	Mag 8, D502, LOP87D351, Logger 49	05/28/96 - 12/26/96
BL	Humidity	Mag 8, D502, LOP87D351, Logger 49	05/28/96 - 12/26/96
BM	Temperature	Mag 8, D563, MA-88H010-003A, Logger K2	05/28/96 - 12/26/96
BN	Humidity	Mag 8, D563, MA-88H010-003A, Logger K2	05/28/96 - 12/26/96
BO	Temperature	Mag 8, D541, IND92G-071641-024, Logger K26	05/28/96 - 12/26/96
BP	Humidity	Mag 8, D541, IND92G-071641-024, Logger K26	05/28/96 - 12/26/96
BQ	External Probe	Mag 8, D541, IND92G-071641-024, Logger K26	05/28/96 - 12/26/96
BR	Temperature	Mag 9, Ambient @ front of mag, Logger 53	- 12/26/96
BS	Humidity	Mag 9, Ambient @ front of mag, Logger 53	05/28/96 - 12/26/96
BT	Temperature	Mag 9, Ambient @ rear of mag, Logger K18	05/31/96 - 12/26/96
BU	Humidity	Mag 9, Ambient @ rear of mag, Logger K18	05/31/96 - 12/26/96
BV	Temperature	Mag 9, D505, LOW86C041, Logger K5	05/28/96 - 12/26/96
BW	Humidity	Mag 9, D505, LOW86C041, Logger K5	05/28/96 - 12/26/96
BX	Temperature	Mag 13, A589, SOD-L-500-30, Logger 63	07/16/96 - 01/02/97
BY	Humidity	Mag 13, A589, SOD-L-500-30, Logger 63	07/16/96 - 01/02/97
BZ	External Probe	Mag 13, A589, SOD-L-500-30, Logger 63	07/16/96 - 01/02/97

MILVAN SPREADSHEET

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Column	Description	Location	Active
A	WX ID Number		
B	Julian Date		
C	Time		
D	Wind Speed (MPH)		
E	Wind Direction		
F	Standard Deviation of Wind Direction		
G	Ambient Temperature (12 feet above ground)		
H	Ambient Humidity		
I	Solar Radiation 350-1150nm		
J	Solar Radiation 285-2800nm		
K	Ambient Temperature (2.5 feet above ground)		
L	Ground Surface Temperature		
M	Battery Voltage		
N	Temperature	MILVAN H3DA, Top of MILVAN, Logger 56	05/28/96 - 12/27/96
O	Humidity	MILVAN H3DA, Top of MILVAN, Logger 56	05/28/96 - 12/27/96
P	Temperature	MILVAN H3DA, 6" Below Top, Logger K22	05/28/96 - 12/27/96
Q	Humidity	MILVAN H3DA, 6" Below Top, Logger K22	05/28/96 - 12/27/96
R	Temperature	MILVAN 25, Top of Load, A589, SOD-L-500-30, Logger 63	05/28/96 - 07/16/96
S	Humidity	MILVAN 25, Top of Load, A589, SOD-L-500-30, Logger 63	05/28/96 - 07/16/96
T	Temperature	MILVAN 97, 6" Below Top, Logger 44	05/28/96 - 12/31/96
U	Humidity	MILVAN 97, 6" Below Top, Logger 44	05/28/96 - 12/31/96
V	Temperature	MILVAN 302, 6" Below Top, Logger 42	05/28/96 - 10/13/96
W	Humidity	MILVAN 302, 6" Below Top, Logger 42	05/28/96 - 10/13/96
X	Temperature	MILVAN 306, Top of Load, N285, HAT90H033, Logger 27	05/28/96 - 09/12/96
Y	Humidity	MILVAN 306, Top of Load, N285, HAT90H033, Logger 27	05/28/96 - 09/12/96
Z	Temperature	MILVAN 334, 6" Below Top, Logger 38	05/28/96 - 12/31/96
AA	Humidity	MILVAN 334, 6" Below Top, Logger 38	05/28/96 - 12/31/96
AB	Temperature	MILVAN 334, Top of Load, D528, PB-90A008-063, Logger K31	05/28/96 - 09/12/96

AC	Humidity	MILVAN 334, Top of Load, D528, PB-90A008-063, Logger K36	05/28/96 - 09/12/96
AD	Temperature	MILVAN 338, Top of Load, D550, PB-90A008-063, Logger K36	05/28/96 - 09/12/96
AE	Humidity	MILVAN 338, Top of Load, D550, PB-90A008-063, Logger K36	05/28/96 - 09/12/96
AF	Temperature	MILVAN 411, Top of MILVAN, Logger K4	05/28/96 - 12/31/96
AG	Humidity	MILVAN 411, Top of MILVAN, Logger K4	05/28/96 - 12/31/96
AH	Temperature	MILVAN 411, 6" Below Top, Logger 19	05/28/96 - 12/31/96
AI	Humidity	MILVAN 411, 6" Below Top, Logger 19	05/28/96 - 12/31/96